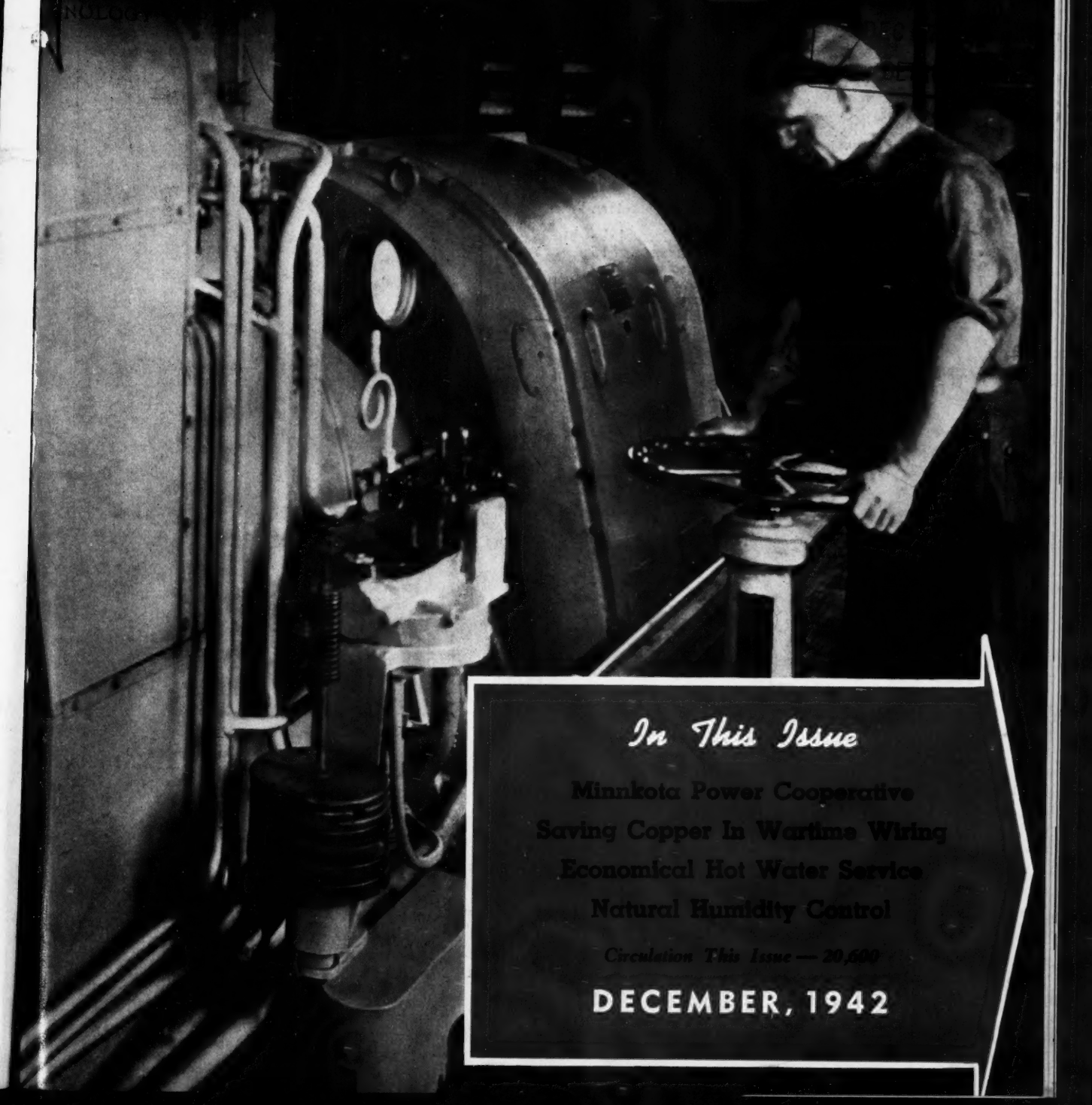
POWER PLANT ENGINEERING

THE PLANT ENGINEERING AND MAINTENANCE MAGAZINE FOR EVERY INDUSTRY



In This Issue

Minnkota Power Cooperative

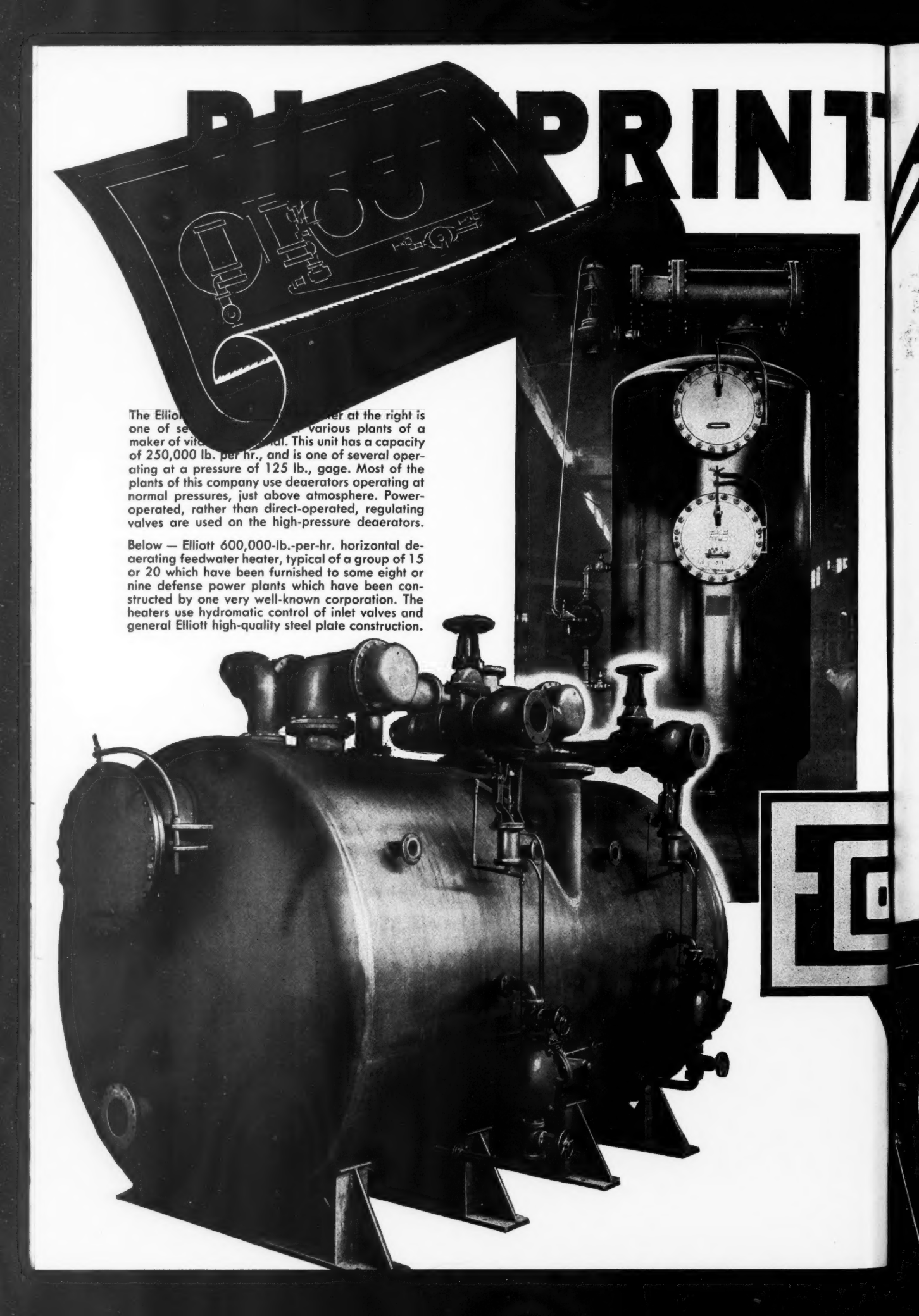
Saving Copper In Wartime Wiring

Economical Hot Water Service

Natural Humidity Control

Circulation This Issue — 20,600

DECEMBER, 1942



The Elliot[t] [...]er at the right is one of se[ve]ral various plants of a maker of vit[al] [...]al. This unit has a capacity of 250,000 lb. per hr., and is one of several operating at a pressure of 125 lb., gage. Most of the plants of this company use deaerators operating at normal pressures, just above atmosphere. Power-operated, rather than direct-operated, regulating valves are used on the high-pressure deaerators.

Below — Elliott 600,000-lb.-per-hr. horizontal deaerating feedwater heater, typical of a group of 15 or 20 which have been furnished to some eight or nine defense power plants which have been constructed by one very well-known corporation. The heaters use hydromatic control of inlet valves and general Elliott high-quality steel plate construction.

for VICTORY

STANDARDIZED DEAERATING HEATER CONSTRUCTION SPEEDS DEFENSE PLANTS

Speed is the need of today. Scores of new power plants are going up, to serve various new ordnance and strategic material plants. In many of these power plants engineers have wisely adopted standardized construction as far as possible, saving much engineering and design work, and best of all, saving invaluable *time*.

Elliott deaerating feedwater heaters, fitting perfectly into this picture, have been furnished for many of these vital plants. Not only do these units heat feedwater to the saturated temperature of the steam supplied, but they also remove dissolved oxygen from the water, preventing corrosion troubles in piping, economizers and boilers.

In line with the savings produced by standardization and simplification, Elliott engineers can often make suggestions in any feedwater heating layout to save materials, extra piping, and perhaps suggest a more effective hook-up. Let's talk it over.

ELLIOTT COMPANY

Deaerator and Heater Dept., **JEANNETTE, PA.**

DISTRICT OFFICES IN PRINCIPAL CITIES

N-968

Keep Your Discharge Valves "in the Clear"!

A FORMULA THAT SOLVES AN IMPORTANT PROBLEM IN EFFICIENT COMPRESSOR OPERATION:

Problem: In principle, an air compressor is just about as simple as a bicycle pump. Its lubrication is also simple, *if you use the correct oil with minimum feeds.*

Peak temperatures are reached when the air is being discharged. As a result, discharge valves are the "hot spots" in your air compressors. Harmful deposits may occur here if too much or improper oil is used. That's why even the *right* oil must be fed sparingly.

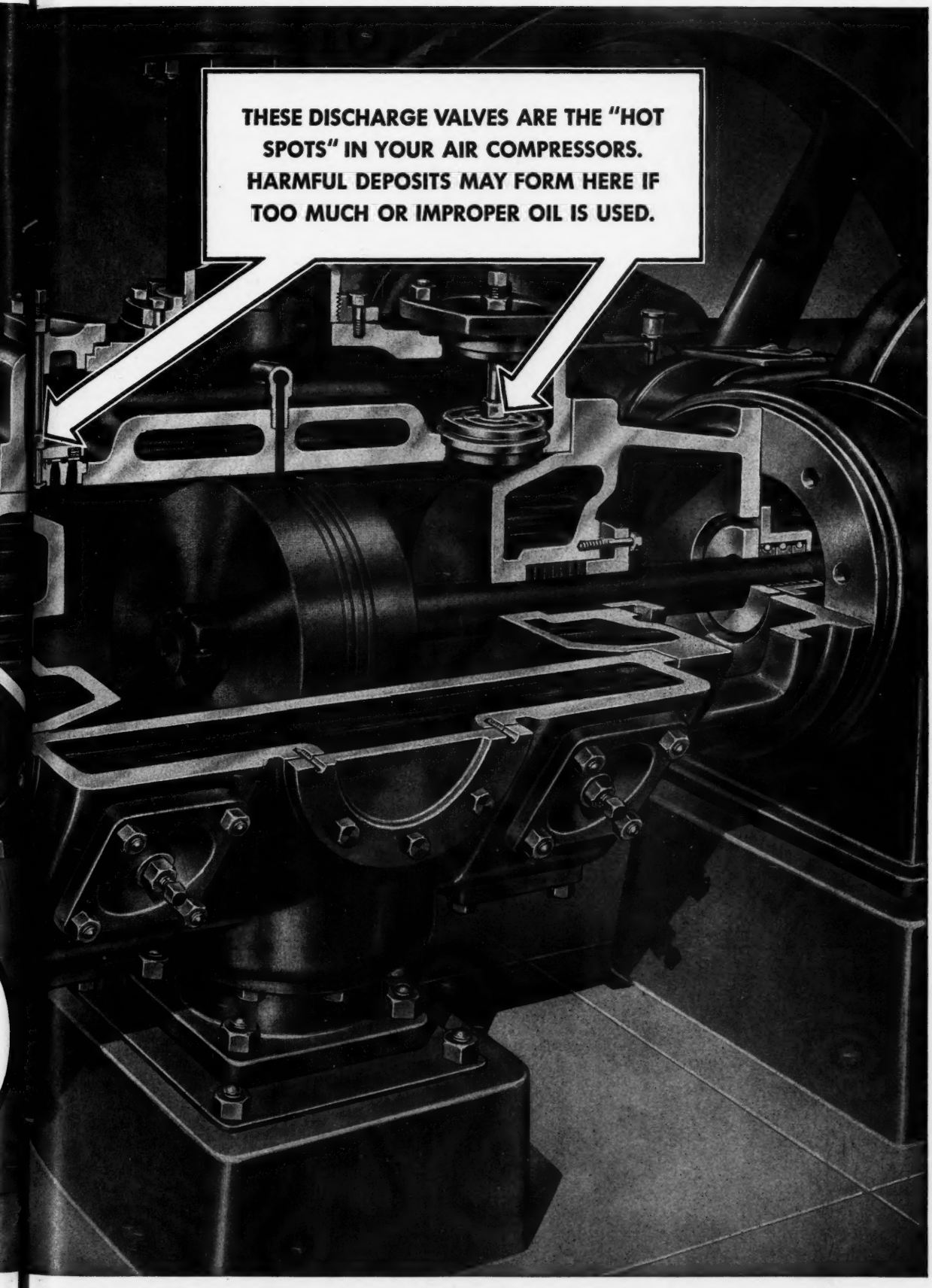
Answer: Call in a Socony-Vacuum man. He is trained to study your particular installation and recommend the right *Gargoyle D.T.E. Oil* for your compressors. He will also assist you in obtaining clean air and correct oil feeds for adequate lubrication. Remember—*clean air* plus *minimum feeds* of the *right oil* equals efficient air compression.

TO HELP MAINTAIN WARTIME PRODUCTION, CALL IN

SOCONY-VACUUM for "Correct Lubrication"

GARGOYLE Lubricants

SOCONY-VACUUM OIL CO., INC. — Standard Oil of N. Y. Div. — White Star Div. Lubrite Div. — Chicago Div. — White Eagle Div. — Wadhams Div. — Southeastern Div. (Baltimore) — Magnolia Petroleum Company — General Petroleum Corporation of Calif.


THESE DISCHARGE VALVES ARE THE "HOT SPOTS" IN YOUR AIR COMPRESSORS. HARMFUL DEPOSITS MAY FORM HERE IF TOO MUCH OR IMPROPER OIL IS USED.

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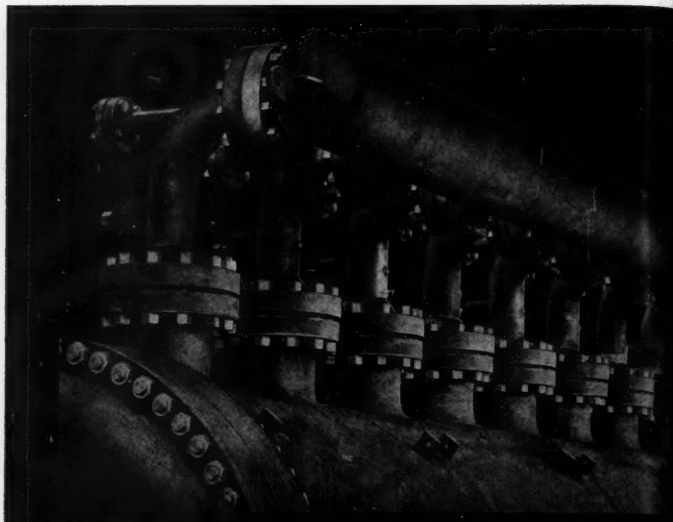
Consult B&W on all High-Temperature High-Pressure Problems



VESSELS FOR HIGH TEMPERATURE SERVICE
Illustration shows vessel with streamlined openings built of Croloy 2 plate for normal service at 100 lb. per sq. in. and 1050 F.

B&W STREAMLINED OPENINGS
All reinforcing forged and drawn from parent metal.

B&W designing skill and manufacturing experience are developing new and practical solutions for many problems encountered by chemical industries engaging in production of butadiene, styrene, toluol, 100-octane gasoline and other ingredients of victory.

B&W EQUIPMENT INCLUDES

Catalyst cases for production of butadiene from both alcohol and butane;

Separately fired high-temperature and high-pressure superheaters for butadiene production;

Fired and waste-heat boilers for butadiene production;

Alloy furnace castings for all processes;

Pressure vessels for all processes producing butadiene, toluol and high-octane gasoline.

B&W ALLOY TUBE SUPPORTS

More than two million pounds of Babcock & Wilcox Tube Support Castings in high-temperature furnaces have been supplied, and not a single service failure has been reported. Service temperatures range as high as 2000 F. under conditions requiring high creep strength, consistent with long-time stability. The castings include all types of supports, together with related links, bolts, nuts, etc.

B&W INTEGRAL FURNACE BOILERS

This type of boiler, a thoroughly coordinated unit of modern design, possesses advantages of especial value in chemical-industry installations. Installation requires minimum alteration of existing structures. A wide variety of fuels is permissible. Particularly notable for their simple, practical construction which makes them exceptionally easy to operate and maintain.*

★ ★ B&W PRODUCTS ★ ★
HELPING REFINERS PRODUCE
INGREDIENTS OF VICTORY!

BABCOCK & WILCOX

THE BABCOCK & WILCOX COMPANY
85 LIBERTY STREET, NEW YORK, N.Y.

* *Complete details appear in Bulletin G-17-A, sent free on request.*

S-30 T

The Utilities

Uncle Sam's Unsung Heroes!

PEARL HARBOR touched off the fuse that blew the might of America into action.

New shipyards sprung up overnight. Tank plants mushroomed. Facilities for making munitions were multiplied, again and again. Plane plants doubled, tripled, quadrupled in number.

America's giant automobile and truck industries were converted to war work in record time. New additions were added, new plants, complete new towns sprung into being on America's industrial horizon almost overnight, creating an unprecedented peak in power demands.

The utilities met this CHALLENGE!

Power and MORE POWER for PRODUCTION became the goal of every utility—became the password of every lineman, of every electrician, of every office worker, engineer and executive in every American Utility.

We, of American Blower, who have been privileged to work with many of the nation's leading producers of power down through the years, are proud of the war record of American Blower Fluid Drives (Hydraulic Couplings), Fly Ash Precipitators, Forced and Induced Draft Fans in the able hands of America's Utilities—Uncle Sam's unsung heroes.

Now we proudly fly the United States Army-Navy "E" for production.

AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT, MICH.

CANADIAN SIROCCO COMPANY, LIMITED, WINDSOR, ONTARIO

Division of American Radiator and Standard Sanitary Corporation

UP AGAINST STACK DISCHARGE?
THEN YOU NEED A-E-CO TAYLOR STOKERS

A CASE IN THE HEATING PLANT FIELD

PROBLEM:

The first and foremost problem when this plant was engineered in 1929 was stack discharge. Located in the heart of a fine residential district, it was imperative that no objectionable smoke or cinders be produced.

SOLUTION:

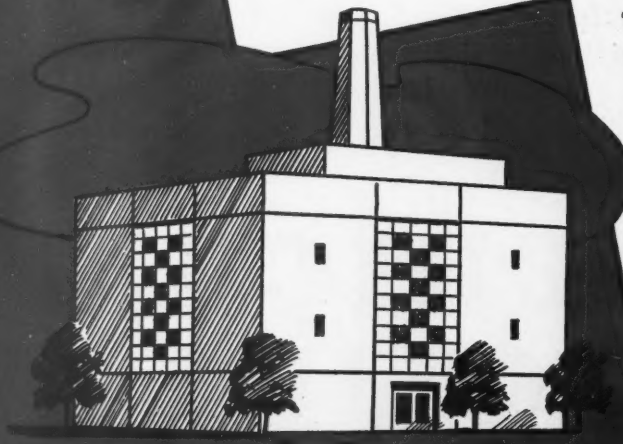
Two Taylor Stokers were finally chosen for this plant, each operating under 550 H.P. boilers—refractory furnace construction throughout and no heat recovery equipment. As an added precaution, because of the delicate public relations problem, the boilers were equipped with cinder-collecting type induced draft fans.

RESULTS:

The Taylor Stokers proved more than a match for the problem. Not only was stack discharge held to an unobjectionable minimum but high efficiency and low maintenance were achieved, burning low grades of Ohio Coal with an average heating value of 12,275 B. T. U. as fired. From the fall of 1939 to spring 1942, 330,334,000 lbs. of steam were generated, burning 34,772,000 lbs. of coal. Average actual evaporation 9.5 lbs. steam per pound coal. Steam pressure 125 lbs. G., moisture in steam 1%, feed temp. to boiler 212°F. Steaming range 25% to 168% of boiler rating. Combined efficiency 77.7%. Material maintenance 2¢ per ton coal as fired since 1929!

CONCLUSIONS:

This case is an outstanding example of the manner in which Taylor Stokers, selected for one prime purpose, deliver *extra* advantages. In this case, although minimum stack discharge was the primary requirement, high efficiency and low maintenance were also achieved. Although cinder-collecting fans were used because of the abnormal demands for minimum discharge, ordinarily these are not required with Taylor Stokers.



AMERICAN ENGINEERING

PHILADELPHIA • PENNSYLVANIA

A-E-CO TAYLOR STOKERS ON THE FIRING LINE

*Aluminum Company of America, Edgewater, N. J.
*Aluminum Company of America, New Kensington, Pa.
American Tobacco Co., Inc., Durham, N. C.
Cassanea Paper Company, Johnsonburg, Penna.
Chrysler Corporation, DeSoto Plant, Detroit, Mich.
*Collins and Aikman Corp., Roxboro, N. C.
City of Columbus, Ohio
*Consolidated Paper Company, Monroe, Michigan
*Cresson State Sanitarium, Cresson, Penna.
Delaware Milk Products Co., Delaware, Ohio
*DeLaval Steam Turbine Co., Trenton, N. J.
*Detroit Sulphite Pulp & Paper Co., Detroit, Michigan
City of Dover, Ohio
*Draper Corporation, Hopedale, Mass.
Erwin Cotton Mills Co., West Durham, N. C.
*Fisher Body Corporation, Detroit, Michigan
Fisher Body Corporation, Fleetwood Plant, Michigan
*Fisher Body Corporation, Grand Rapids, Michigan
*Fisher Body Corporation, Pontiac, Michigan
Fox Paper Company, Lockland, Ohio
Froedtert Grain and Malting Co., Milwaukee, Wisc.
*City of Galion, Ohio
*Gardner-Richardson Company, Lockland, Ohio
*General Electric Company, Erie, Penna.
*General Electric Company, Fort Wayne, Ind.
*Greenwood Electric L. & W. Plant, Greenwood, Miss.
*Board Public Works, Hannibal, Mo.
Hill School, Pottstown, Penna.
*Hobart Mfg. Co., Troy, Ohio
*City of Holland, Michigan
*Hope Natural Gas Co., Cornwell Station, West Va.
Hudepohl Brewing Co., Cincinnati, Ohio
Industrial Cotton Mills, Rock Hill, S. C.
*City Water & Light Plant, Jonesboro, Ark.
Kohler Company, Kohler, Wisc.
Maryland State Penal Farm, Roxbury, Md.
*Marbury Sanitarium, Northville, Michigan
Michigan Carton Company, Battle Creek, Michigan
*Michigan State College, East Lansing, Mich.
Municipal Light Plant, Marshfield, Wisc.
*Pacific Mills, Lyman, S. C.
*Packard Motor Car Co., Detroit, Michigan
*Municipal Electric Plant, Paintsville, Ohio
*Park Drop Forge, Cleveland, Ohio
*Pennsylvania Electric Co., Seward, Penna.
*Pennsylvania R. R. Co., Philadelphia, Penna.
*Picatinny Arsenal, Dover, N. J.
*Pittsburgh Plate Glass Co., Barberton, Ohio
Borough of Quakertown, Quakertown, Penna.
Raleigh Wyoming Mining Co., Glen Rogers, W. Va.
*Rhinelander Paper Company, Rhinelander, Wisc.
City of Richland Center, Wisconsin
*City of Richmond, Indiana
Sayles Biltmore Bleachery, Biltmore, N. C.
Scotten Dillon Company, Detroit, Michigan
Shelby Cotton Mills, Shelby, N. C.
Sloane-Blabon Corp., Philadelphia, Penna.
*Solvay Process Company, Detroit, Michigan
*St. Elizabeth's Hospital, Washington, D. C.
City of St. Bernard, Ohio
Swarthmore College, Swarthmore, Penna.
*Timken Roller Bearing Co., Canton, Ohio
Timken Roller Bearing Co., Gambrinus, Ohio
Municipal Water & Light Plant, Tippecanoe City, O.
City of Toledo, Ohio
*Union Bleachery, Greenville, S. C.
Union Mills Paper Mfg. Co., New Hope, Penna.
*University of Wisconsin, Madison, Wisc.
*Vassar College, Poughkeepsie, New York
*Borough of Vineland, New Jersey
Warfield Natural Gas Company, Harold, Kentucky
White Sewing Machine Co., Cleveland, Ohio
Whiting Plover Paper Company, Stevens Point, Wisc.

(*) *Represents repeat orders.*

A-E-CO TAYLOR STOKER

A-E-CO TAYLOR STOKERS
WALLS-ASH HOPPERS
HAW FLUID POWER
DECK AUXILIARIES
CO-HER HOISTS
MPANY

BEFORE YOU BUY ANY FUEL FIRING EQUIPMENT CONSIDER EACH OF THESE 12 FACTORS

1. **RELIABILITY**—the ability to operate with minimum outage and minimum standby equipment.
2. **CAPACITY**—the ability to provide adequate prime capacity ratings, with sufficient reserve capacity for emergencies.
3. **MAINTENANCE**—the ability to operate continuously with minimum repair costs.
4. **FLEXIBILITY**—the ability to follow the steam demand upward or downward . . . quickly and without sacrificing efficiency.
5. **EFFICIENCY**—the proved dollar efficiency (total cost of steam production) as shown by actual performance in similar installations.
6. **OPERATION**—the ability to operate continuously, the number and type of operations required, the ease of combustion adjustments, etc.
7. **ADAPTABILITY**—the ability to meet special and limiting conditions, present and future—structural limitations, utilization of present equipment, growth and change of power service demands.
8. **FUEL FLEXIBILITY**—the ability to burn efficiently and easily fuels from many sources having widely varying characteristics.
9. **REFUSE DISPOSAL**—the ability to economically eliminate ash or refuse and the opportunities of disposal at low cost, no cost, or profit.
10. **STACK DISCHARGE**—the practical elimination of "smoke nuisance" without special equipment.
11. **SPACE REQUIREMENTS**—the ability to conform to existing or future space limitations, to short and wide or long and narrow furnaces. Also the accessibility of component parts for maintenance and operation.
12. **OBSOLESCENCE**—the adaptability of the equipment toward possible future modernization with minimum of complication and outage.

Conservation of boilers

Don't have to say:
"ANOTHER BOILER DOWN FOR REPAIRS"
Time was when you would have taken a situation like this as an inevitable matter of course. You would have had the reserve capacity to make all the steam you needed. You had, or could easily get, replacement parts. We weren't at war then. Steel wasn't on the critical list. Today, a tube failure is often a near calamity. A boiler down may mean a serious delay in war production. You can't afford to let it happen. It won't if your plant has "preventive care."

is a wartime MUST!

Clearly . . . You can't have your cake and eat it.
Materials shortage makes replacement a headache.

NOTHING could be plainer. With everything made from steel next to impossible to get, you're faced right now with a repair parts problem. There's only one way out—you've got to make the most of everything you have. You've got to keep it working. It's become a wartime "must."

> . . . if Hall Boiler Plant Service had been expressly created to help you in this situation it couldn't have been better designed for the task.

For Hall Service is definitely designed to give "preventive care." It works on the principle that when the right things are done at the right time, boiler troubles will be caught before they get a start. Many repairs won't be needed. Scale, corrosion, carryover and embrittlement, the ever-present enemies of steam output, will be kept under perpetual control.

The origin of this service dates back to World War I. Old-timers in the power field don't need to be reminded of the appalling situation they faced when real "preventive remedies" for boiler ills were practically unknown. It was Hall research, born of this need, in 1922, which has since paid rich dividends to American industries. Not a high-pressure boiler in use today fails to benefit from it, not a low-pressure boiler to which its benefits are not equally available.

No ordinary routine comprises a Hall Field Engineer's work. In close cooperation with the power plant operator every possible avenue for trouble from water is watched. A system is set up which, if properly followed, reduces boiler outages therefrom to a positive minimum. Continuous peak steam production is a practical certainty.

If you have been, or may soon be facing the inevitable penalty of pushing your equipment to the limit, this is the time to find out what Hall Service is accomplishing in hundreds of America's war industries. Write, phone or wire.

HALL LABORATORIES, INC., HAGAN BLDG., PITTSBURGH, PA.

HALL SERVICE IN A NUTSHELL

At your immediate disposal are placed the technical knowledge and facilities of the pioneering leaders in scientific boiler water conditioning.

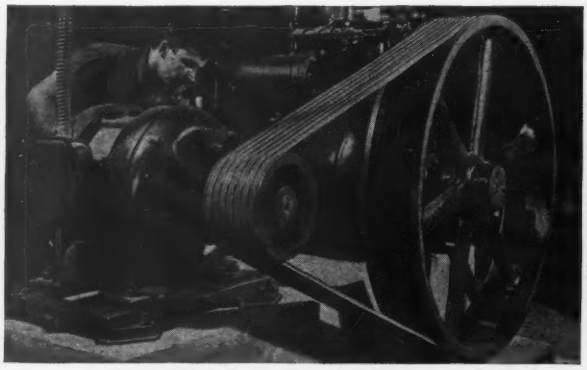
In addition, with your full cooperation, Hall Service:

1. **Minimizes boiler outages caused by water.**
2. **Helps maintain highest efficiency.**
3. **Establishes non-embrittling water.**
4. **Minimizes carryover.**
5. **Prevents corrosion in boilers and associated equipment.**
6. **Prevents deposition in water lines and cooling systems.**

HALL SYSTEM *of Boiler Water Conditioning*

It's Time to Look at Motor

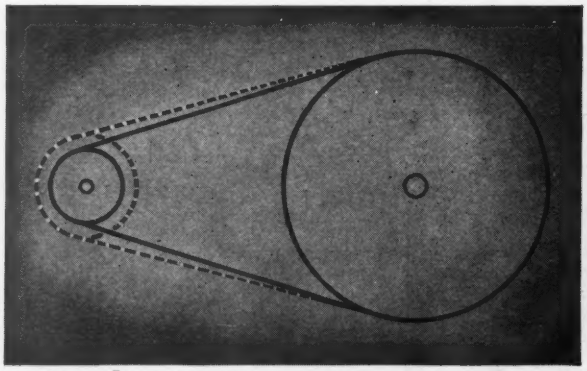
➔*You Can Save with High-Speed Instead of*



1. In most applications, an 1800 rpm motor with Texrope Drive will ably do the job of a lower-speed, direct-connected motor . . . *and* give you *exactly* the speed you want — *at lower cost!*

2. When you buy an 1800 rpm instead of 450 rpm 15 hp squirrel-cage motor, for example, 600 lb of critical materials are saved. And *you* save well over $200—with the drive figured in! This saving is typical.

➔*You Can Save with Single-Speed Instead of*



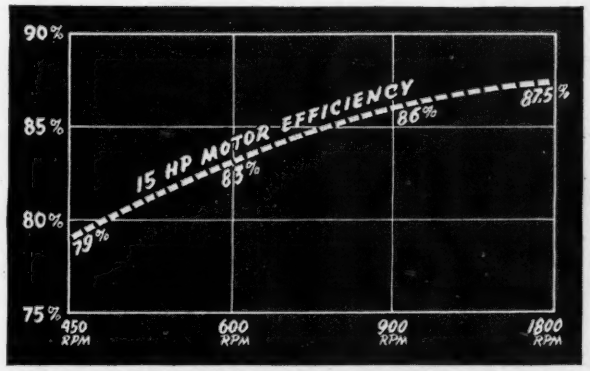
1. Infrequently needed speed changes can be had by changing from one size motor sheave to another. By juggling *complete* drives, speeds can be changed over the full range — from 1:1 to 7:1.

2. With the Allis-Chalmers Vari-Pitch Sheave, you can increase or decrease speed by adjusting sheave diameter, as above. Within limits, an unbroken series of speeds can be obtained.

Take a Fresh Buying!

WAR FORCES HIGHER EFFICIENCIES...

Low-Speed Motors...



3. Note that efficiency rises from 79% for a 450 rpm motor to 87.5% for a 1800 rpm motor. Comparing power consumption, the 1800 rpm motor saves you over 30 kw/24 hr. day.

Multi-Speed Motors...

3. Allis-Chalmers Vari-Pitch Speed Changer gives you infinite changes at the turn of a wheel — within 3.75 to 1. It's the most compact, flexible variable-speed transmission available.

It was good business in peacetime to use — as widely as possible — high-speed motors with Allis-Chalmers Texrope Drives...and single-speed motors with Allis-Chalmers Vari-Pitch Sheaves and Speed-Changers. And it's clearer every day that those material and money-saving practices are *vital* practices in time of war!

TODAY the whole picture of buying and applying motors has changed. Note at the left how much you can save for your country *and yourself* with high and single-speed motors made flexible by Texrope Drives.

As America's only builder of both electric motors and V-belt drives,* Allis-Chalmers has long advocated the proper combining of motor and V-belt drive.

And today you benefit from Allis-Chalmers' vast, pioneering experience in this field when you ask for and get the *right* combination of Lo-Maintenance Motor and Texrope Drive! Call your nearby district office. Or write ALLIS-CHALMERS MFG. CO. MILWAUKEE, WISCONSIN.

A 1560

*Allis-Chalmers *originated* the Multiple V-Belt Drive and Vari-Pitch Sheaves.

ALLIS-CHALMERS A-C MILWAUKEE

WE WORK FOR VICTORY

WE PLAN FOR PEACE

bearings gobbled

grease like

...hungry wolves

until this plant switched to Tycol Green Cast Greases

Lubricating a soap-cooling machine consisting of two large steam heated drums and two water-cooled rolls was a continuous problem to this plant. Steam passing through the roll hubs at 300° F. made bearings so hot that grease quickly thinned down and dripped away. Even though grease boxes were filled every day, bearings were constantly burning out. Then a Tide Water engineer recommended switching to Tycol Green Cast Grease. Since making the change this plant has ended former lubrication worries, and cut down extravagant grease consumption.

"Our practice now," says the plant superintendent, "is to put about five pounds of grease into each box and almost forget about them for two weeks or longer. Tycol is undoubtedly the right grease for the job. It stands the high temperatures and does a thorough job of lubricating. The amount of grease we save, the repair bills we avoid, and the hours of labor we do away with make this decidedly an example of how waste can be eliminated by using the correct grease." Tycol Green Cast Greases are made with fine quality cylinder oils and a minimum of soap. More cylinder oil — less soap means better lubrication under all operating conditions.

Let a Tide Water engineer show you how to step up production through efficient lubrication. Write the Tide Water Associated Oil Company, 17 Battery Place, New York, N. Y.

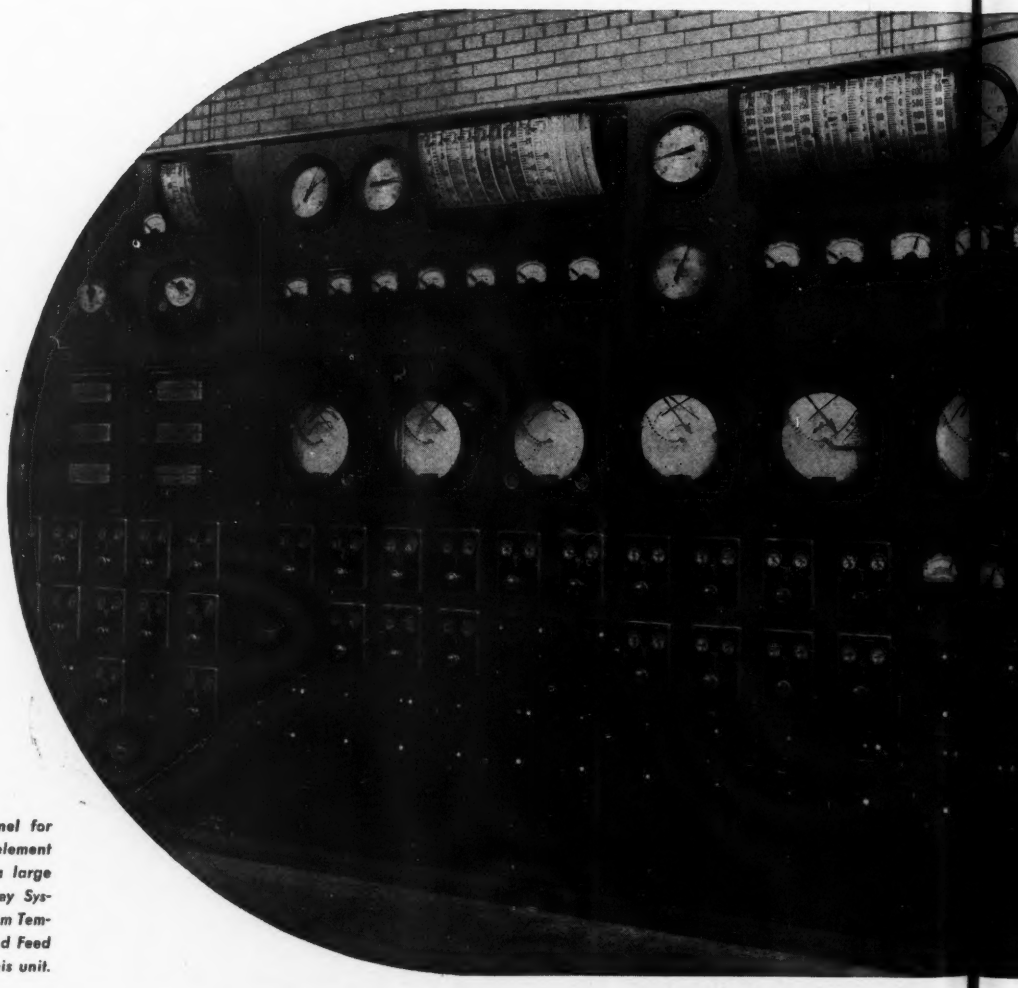
DRUMS! DRUMS! DRUMS! DRUMS!
War needs make it extremely important that all empty drums be returned immediately.

TIDE WATER ASSOCIATED OIL COMPANY
EASTERN DIVISION: 17 BATTERY PLACE, NEW YORK
Principal Branch Offices: Boston, Philadelphia, Pittsburgh, Charlotte, N. C.

MAKERS OF THE FAMOUS VEEDOL MOTOR OIL

"AN OUNCE OF
IS BETTER -

Boilers, Furnaces, S
-to-Replace Units C



Bailey Meter Control Panel for Combustion and Three-element Feed Water Control on a large Power Boiler. Other Bailey Systems for the control of Steam Temperature, Heater Levels and Feed Water Pumps also serve this unit.

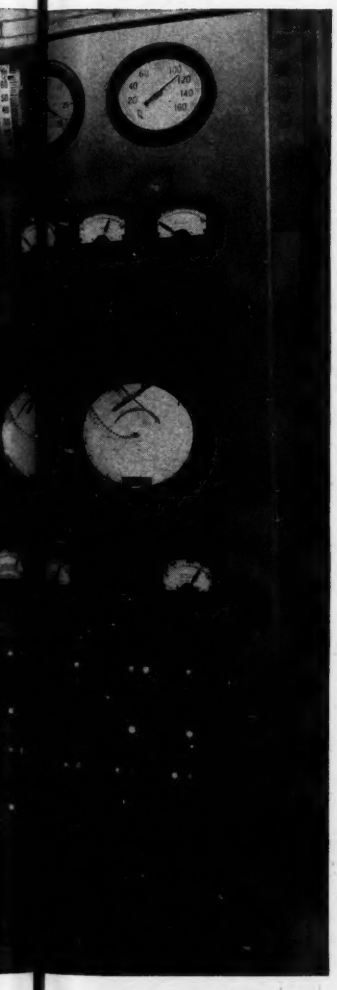
BAILEY METER CONTROL...

BOILER METERS • MULTI-POINTER GAGES • FLUID METERS • RECORDERS • SUPERHEAT ONTI

PREVENTION

- - - "

Superheaters, Turbines, Pumps and other Hard- Can Be Protected by *Bailey Meter Control*



★ Before the battle of production, an outage of a power unit usually had little effect on productive capacity, replacement parts could be quickly secured, and experienced maintenance men were available. Now all this is changed and the power engineer must try harder than ever to avoid the always costly shut down for repair.

Bailey Meter Control is an effective defense against many of the causes for such shut downs, such as:

1. Destructively high furnace temperatures.
2. Dangerously low or high water levels.
3. Excessive steam temperatures.
4. Insufficient flow through boiler feed pumps and superheaters.
5. Loss of ignition in the furnace.
6. Explosive mixtures of fuel and air.
7. Unsafe operating sequences.

Even with inexperienced operators, Bailey Meter Control enables the power engineer to secure continuity of operation, together with fuel conservation and protection for both personnel and equipment.

If your plant is engaged in War Production, we suggest that you investigate fully the possibilities of preventive maintenance made possible by Bailey Meter Control.

BAILEY METER COMPANY

1040 IVANHOE ROAD • CLEVELAND, OHIO

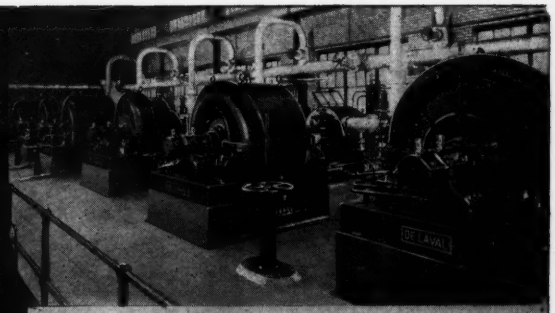
Bailey Meter Company Limited, Montreal, Canada

BAILEY METERS

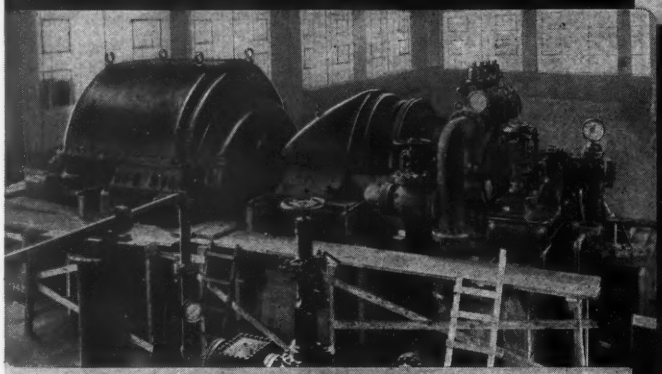
. . . . *The Complete Boiler Control System*

EAT ONTROL • DESUPERHEAT CONTROL • COMBUSTION CONTROL • FEED WATER CONTROL

For Air and Gas Blowers, Compressors and Exhausters *Consult* DE LAVAL



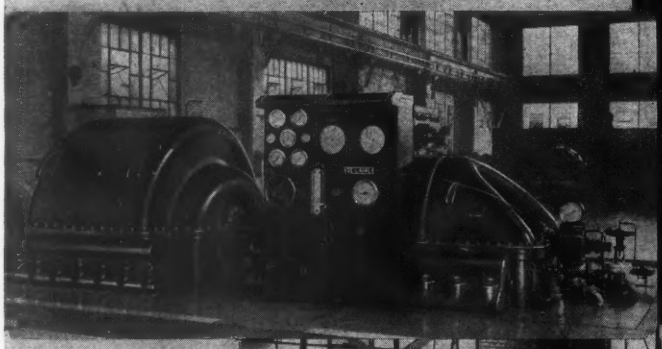
Six De Laval turbine-driven exhausters and boosters in a coke-oven plant. Three are rated at 31,365 c.f.m. each, two at 18,600 c.f.m. each, and one at 25,200 c.f.m.



A 115,000 c.f.m. turbine-driven compressor on test at the De Laval Works.

During recent years numerous repeat orders for De Laval air and gas handling equipment have been entered by large blast furnace plants, by-product coke-oven operators, and domestic gas works. In constructing both the steam power and gas ends of these machines, and also the controls, advantage has been taken of the latest improvements in design and in materials, and their satisfactory operation is testified to by the fact that the users come back to De Laval again as needs expand.

Ask for Catalog F-3824, which contains tables, charts and instructions for the solution of gas handling problems.

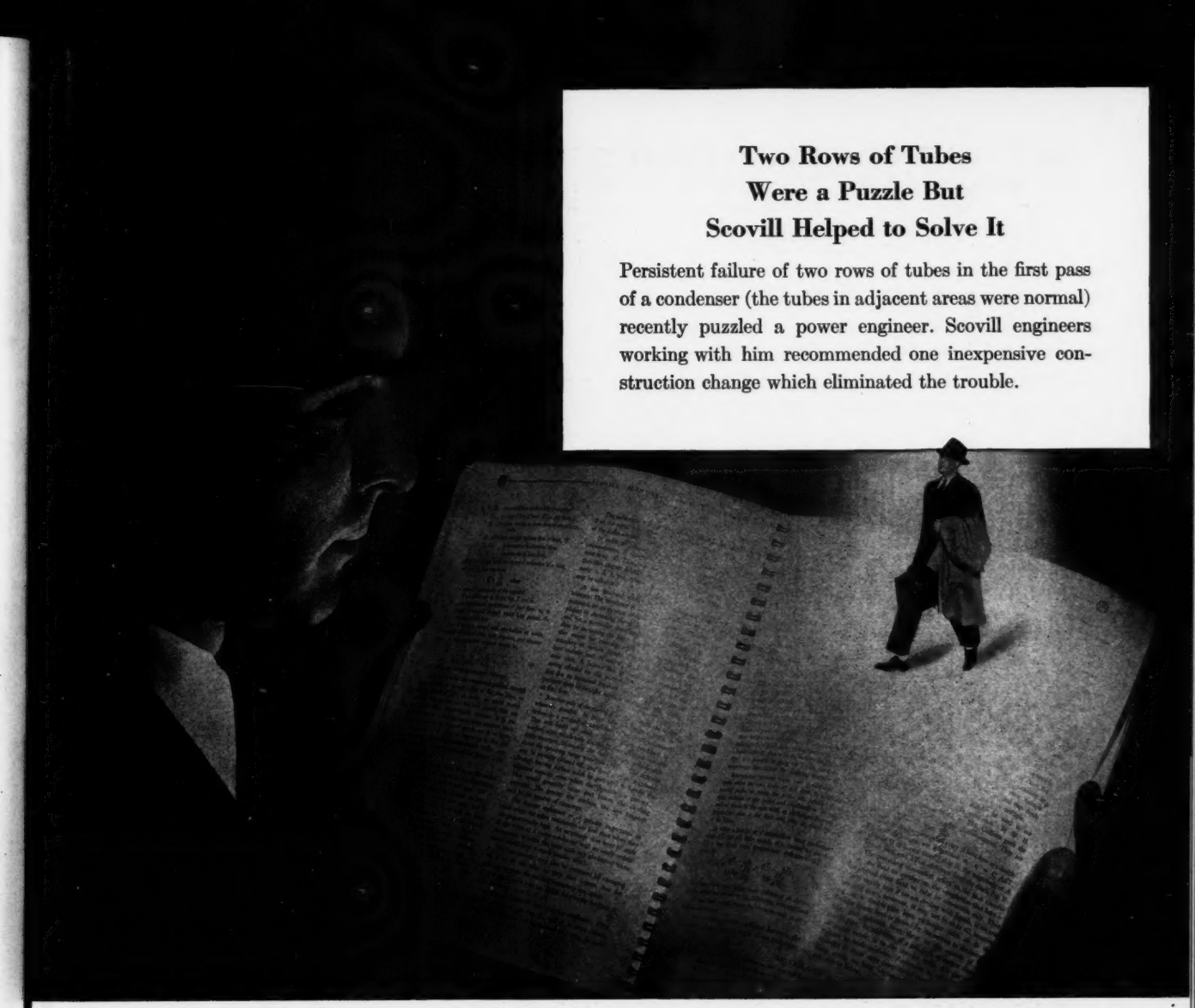


75,000 c.f.m. unit installed earlier in same plant and for same conditions as 85,000 c.f.m. blowers shown below.

• • •

Turbine-driven blast furnace blower; 85,000 c.f.m. of air against 30 lb. at 2800 r.p.m.; turbine using steam at 400 psig and 700° F.

DE LAVAL STEAM TURBINE CO. . . TRENTON, N. J.



Two Rows of Tubes Were a Puzzle But Scovill Helped to Solve It

Persistent failure of two rows of tubes in the first pass of a condenser (the tubes in adjacent areas were normal) recently puzzled a power engineer. Scovill engineers working with him recommended one inexpensive construction change which eliminated the trouble.

Call on the man between the lines

To Help Solve <u>Your</u> Condenser Tube Problems

$$R = \frac{Dvp}{u} = \frac{DG}{u}$$

. . . and the combined experience of the men who serve Scovill heat exchanger customers is almost sure to equal a practical, economical solution of any tube difficulties you may encounter.

Much of this combined knowledge is contained in our new Heat Exchanger Tube Manual; but beyond that, you'll find the man *between the lines* well qualified to help you in your special problems whether it be corrosion of metals, methods of installation, fluid flow, heat transfer, or specifications.

Should that problem involve Reynolds' number . . . the transition point between viscous and turbulent flow . . . dezincification . . . vaporization . . . or merely the standard tolerances for seamless tubing . . . we can probably promptly supply exactly the information you need — background information that springs from the practical experience of Scovill consultants who have helped to solve problems like yours.

The revised edition of the Scovill "Heat Exchanger Tube Manual" is reserved for distribution to engineers and other technical men whose positions frequently require them to have access to a source of material which covers many of the more unusual aspects of heat exchanger tube engineering and operation.

★ ★ ★ ★ ★ ★ ★

For an informative source for those problems having to do with the manufacture, material selection and installation of Condenser Tubes, Scovill's Service in Manuals has produced another booklet — "Scovill Condenser Tubes" available on request. Write to Scovill Manufacturing Company, 17 Mill St., Waterbury, Conn.

SCOVILL
Masters of Metal

Scovill Condenser Tubes

ONE PRODUCT...THREE SERVICES

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- SERVICE IN METALS
- SERVICE IN MANUALS

DEAERATOR CONTROL SYSTEM

Modern boiler operation demands the removal of dissolved air from boiler feedwater to prevent pitting and embrittlement. There are many variables that effect load changes on the boiler, and any load change that causes pressure variations in the Deaerator will decrease the efficiency of the dissolved air removal from the feedwater.

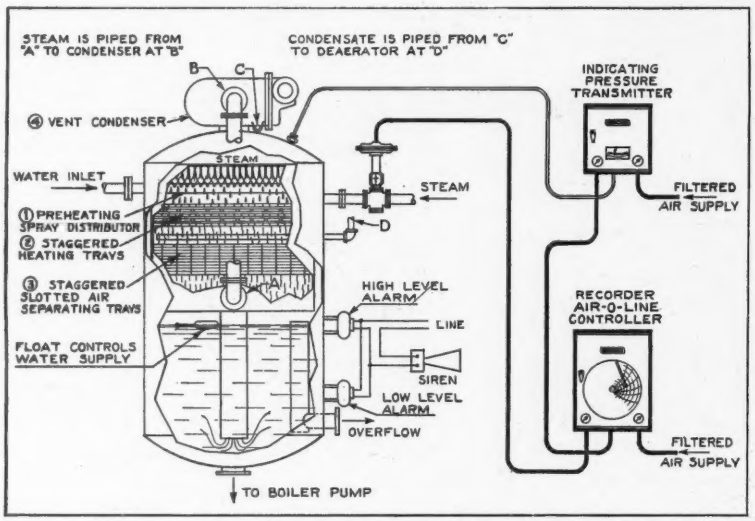


Figure 1. The Brown Remote New-Matic Deaerator Control System regulates steam input according to surges of pressure or flow, and provides reset action to compensate for load changes.

1. *Principles Involved*

Deaerators are generally located above feedwater equipment and at a point remote from the boiler control panel and, because of the low operating pressures carried on most Deaerators, the water head due to difference of elevation is great enough that sensitive, accurate control cannot be obtained if the deaeration head is suppressed in the instrument. It is therefore desirable to locate the pressure gauge at the level of the Deaerator. On the other hand, the recording controller should be on the boiler panel board. This is convenient when we use remote pneumatic transmission of the pressure to a recording controller located on the boiler control panel or at operating level, with its indicating transmitter located at the Deaerator. The *Brown New-Matic Remote Control System* is ideally suited for this application since it provides an indicating scale at the Deaerator where readings may be desired, and a recorder at any remote point in the boiler house.

The Brown New-Matic indicator mechanism transmits a change in air pressure as required by changes in Deaerator pressure through a small bore tubing to the remote recording controller.

The transmitter consists of two main parts, the pilot valve and the transmitter mechanism. The purpose of the pilot valve is to amplify the nozzle pressure and greatly increase the volume of air for transmission to the receiving instrument. This pilot is a non-bleed balanced type, using air only when increasing the transmitted air pressure. It is pressure balanced by virtue of a double bellows, one of which is subjected to nozzle pressure and the other to the transmitted air pressure. The pilot valve is capable of increasing the transmitted air pressure for 90% of a total change from 2 to 15 pounds, with 500 feet of connected tubing, in 15 seconds. The same speed of response applies when the valve is exhausting.

A complete cycle of operation for an increase of pressure is given below:

1. With an increase of pressure, the connecting link to the transmitting unit moves to the right.
2. The movement of the connecting link rotates the flapper lifting lever around its pivot, shown just above the nozzle, and moves the flapper pin away from the flapper, allowing it to move downward and throttle the nozzle opening.
3. When the nozzle is throttled, the pressure in the bellows chamber is increased and the bottom of the bellows moves upward compressing the bellows spring. This movement of the bellows forces the bellows rod upward rotating the bell crank about its fixed pivot, and carries the flapper lifting lever with it. This movement continues until the flapper is in the exact position of maintaining the pressure at exactly the value that represents the new pressure, and there is no further movement of the bellows. For a decrease in pressure, the operation is merely the reverse of the above.

The actuating element of the Brown New-Matic receiver is similar to the transmitting unit except that it has no flapper and nozzle. The bellows and bellows springs are identical with those used in the transmitter unit and linear calibration is always obtained.

The liquid level alarm system is comprised of two Minneapolis-Honeywell high pressure water level cut-off switches mounted in such a way as to sound an alarm when the water levels are above or below the proper levels.

2. *Application Data*

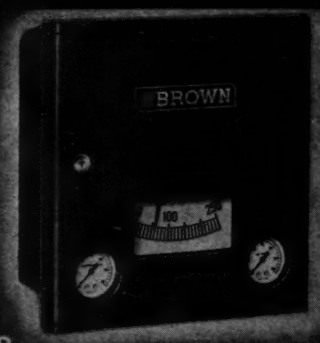
There are two common types of feedwater heaters—the closed or indirect type, which consists of a tubular heat exchanger with water in the tubes and steam in the space surrounding them, and the open or contact type, in which the steam and water are in direct contact. Each has its application: the first, where exhaust steam contains considerable oil or where high temperatures are required, and the latter, where deaeration and purification are desired and limited temperatures are sufficient.

Open heaters usually operate at from 1 to 5 pounds pressure and as the steam and water are mixed, both latent and sensible heat of the steam is absorbed by the water, resulting in a feedwater temperature being within ½° F. of the temperature of the steam at the heater operating pressure. Temperature control is extremely critical if deaeration is desired, and if steam binding in the feed pumps is to be avoided. The water temperature must be maintained constantly within ± 1° F. of the boiling point which is the equivalent of a pressure change of approximately ⅛ lb. Unless sufficient quantities of exhaust steam are available at all times to insure this condition, a live steam cross over should be employed including a reliable and sensitive pressure regulator. Only under these conditions may complete removal of oxygen and other non-condensable gases such as CO_2 be accomplished. These gases are continuously vented to atmosphere, usually through a vent condenser, or heat exchanger. Steam binding of pumps, while no problem on a temperature rise, will always show on the slightest drop in temperature.

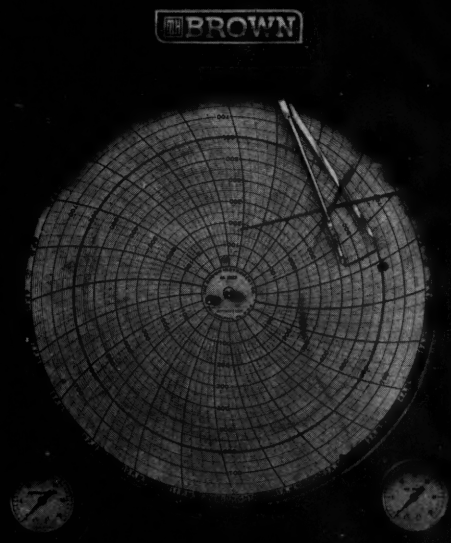
The Brown Deaerator Control System is particularly desirable because it has the following characteristics:

1. Responds to pressure changes rather than temperature changes, therefore responds to minute variations in conditions.
2. The New-Matic principle permits the use of remote transmission methods, and avoids errors due to water leg in tubing.
3. Control point may be adjusted conveniently at the panel board.
4. The transmitter is equipped with an indicating scale at the Deaerator.
5. If desired, the water level in the Deaerator may be recorded on the same chart as the pressure, by the simple addition of a level receiver unit in the recorder and an indicating level transmitter at the Deaerator.

For complete details write THE BROWN INSTRUMENT COMPANY, *a division of Minneapolis-Honeywell Regulator Co.*, 4491 Wayne Avenue, Philadelphia, Pa.



INDICATING TRANSMITTER



AIR-O-LINE RECEIVER

Centralizes Remote Measurement and Control of DEAERATOR

All Brown "New-Matic" Systems are equipped with identical bellows in both the transmitting and receiving instruments. These bellows are factory "matched" to rigid specifications, insuring accurate calibration throughout the pressure range.

RESPONSE

Rapid rate of response is obtained through the use of a new non-bleed pilot. With tubing lengths as great as 1,000 feet, the receiver pen will travel through full scale at a rate equivalent to the most rapid rate of mercury differential change ever encountered in flow meter practice. With the thermometer transmitters it has been proven that the response is even more rapid than with long lengths of capillary.

ACCURACY

Positioning of the recording pen is guaranteed to within 1/10 of 1% of full scale range. Precision workmanship in all moving parts eliminates any appreciable hysteresis errors. The system is unaffected by ambient temperature changes of fluctuating air supply pressure.

POWER

The extra large spring and bellows design insures ample power for pen positioning and control mechanism operation. There is no "pen drag" or tapping error.

The Brown "New-Matic" Remote Transmission System is safe, stable, accurate and powerful, and lends itself admirably to the growing demand for centralized recording and control without any of the drawbacks attendant to long lengths of meter piping or capillary tubing, and where the use of electricity is not desirable.

Send for Catalog 9400

Write THE BROWN INSTRUMENT COMPANY, 4491 Wayne Avenue, Philadelphia, Penna. Offices in all principal cities.

BROWN *NEW-MATIC* TRANSMISSION SYSTEM

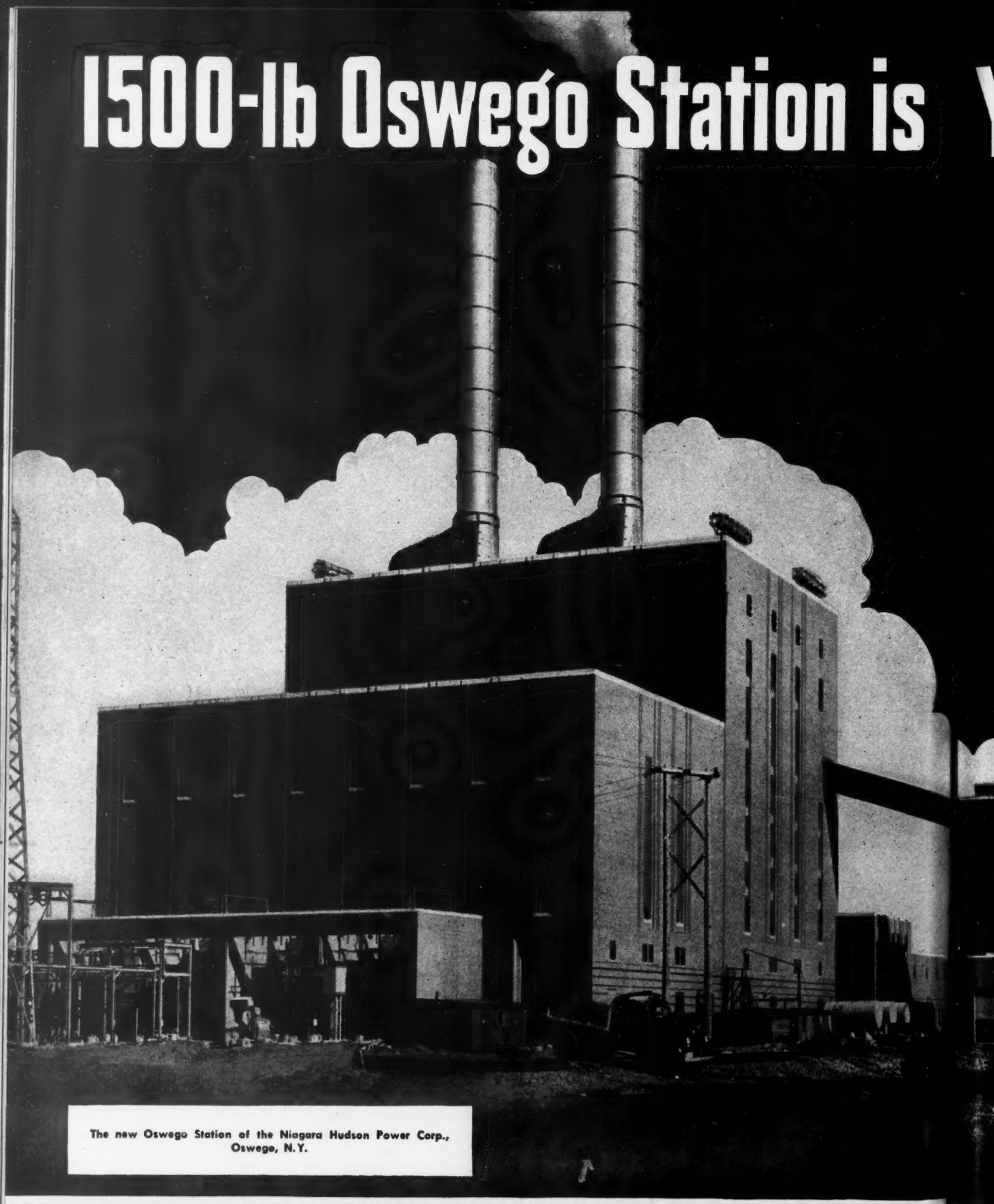
THE BROWN INSTRUMENT COMPANY, PHILADELPHIA, PENNSYLVANIA

DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR CO.

MINNEAPOLIS, MINNESOTA, AND 119 PETER STREET, TORONTO, CANADA

TO MEASURE AND CONTROL IS TO ECONOMIZE

1500-lb Oswego Station is Y



The new Oswego Station of the Niagara Hudson Power Corp., Oswego, N.Y.

YARWAY

Yarway Unit Tandem Equipped

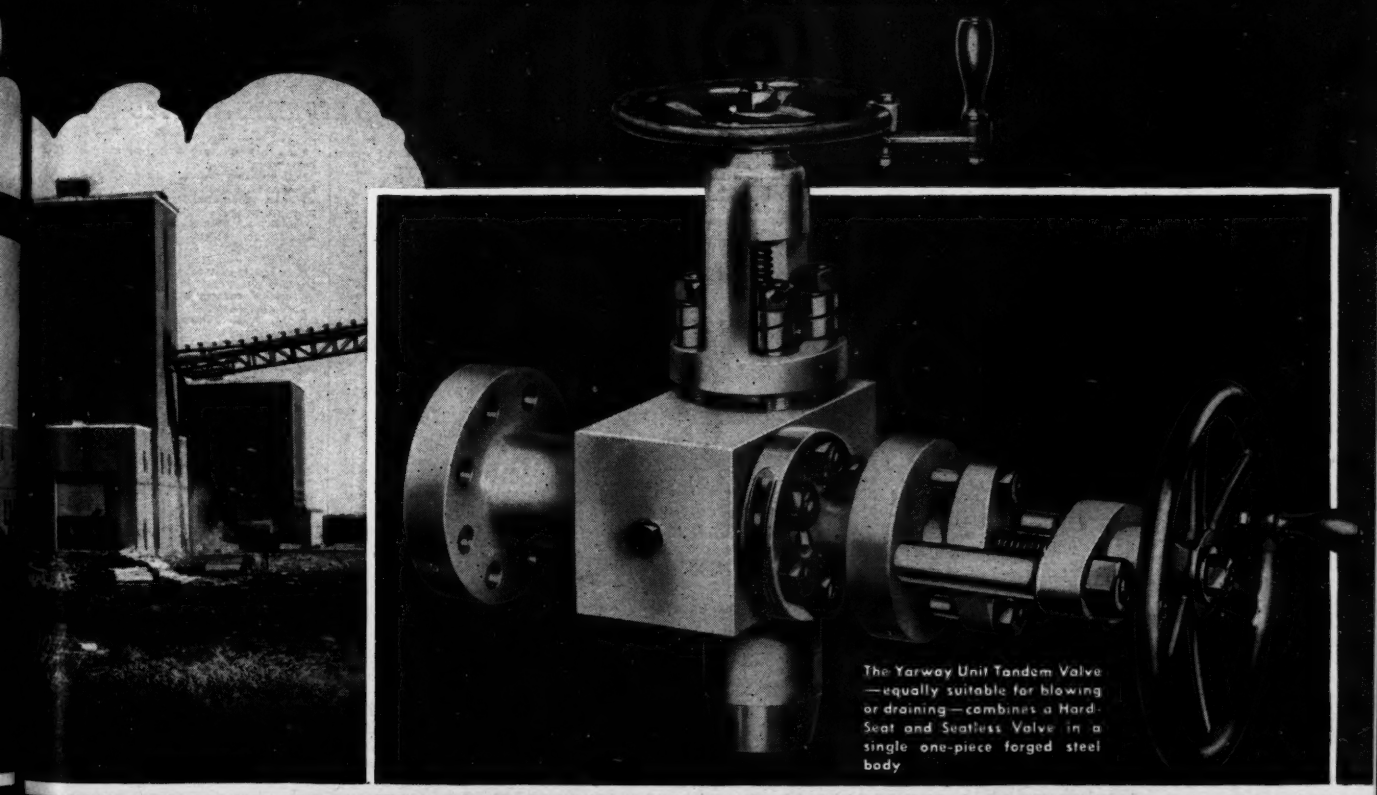
ANOTHER of the many important high-pressure utility stations to select Yarway Unit Tandem Blow-Off Valves for the most difficult of all valve services—the 1500-lb pressure Oswego Station of the Niagara Hudson Power Corp. This installation brings the number of Yarway equipped plants designed for 900 lb pressure and over to ninety-seven.

The reason for Yarway's outstanding preference is found in such records as —"*Still tight after 3000 blows at more than 1300 lbs pressure without replacement of a single part or repairs of any nature.*"

Good boiler engineering demands equally sound engineering in the accessories that become part of it. It is not only *protection for your investment, but cheap insurance against trouble and expense.*

Write for Catalog No. 431 for pressures from 400 lbs to 2500 lbs. Catalog 422 for lower pressures.

YARNALL-WARING COMPANY
114 Mermaid Ave. Philadelphia



The Yarway Unit Tandem Valve —equally suitable for blowing or draining—combines a Hard-Seat and Seatless Valve in a single one-piece forged steel body

BLOW-OFF VALVES

TO FACILITATE quickly the installation of new and the conversion of old drives, Morse Dealer and Factory Branches in many parts of the country are maintaining readily available stocks of Morse Silent Chain Drives, Roller Chain Drives and Sprockets. Every effort is being made to keep these stocks adequate to meet your drive requirements. This service is maintained to keep War production rolling. Call on your local Morse Representative. If he cannot meet your specifications out of stock, he will assist you in securing such from the factory.

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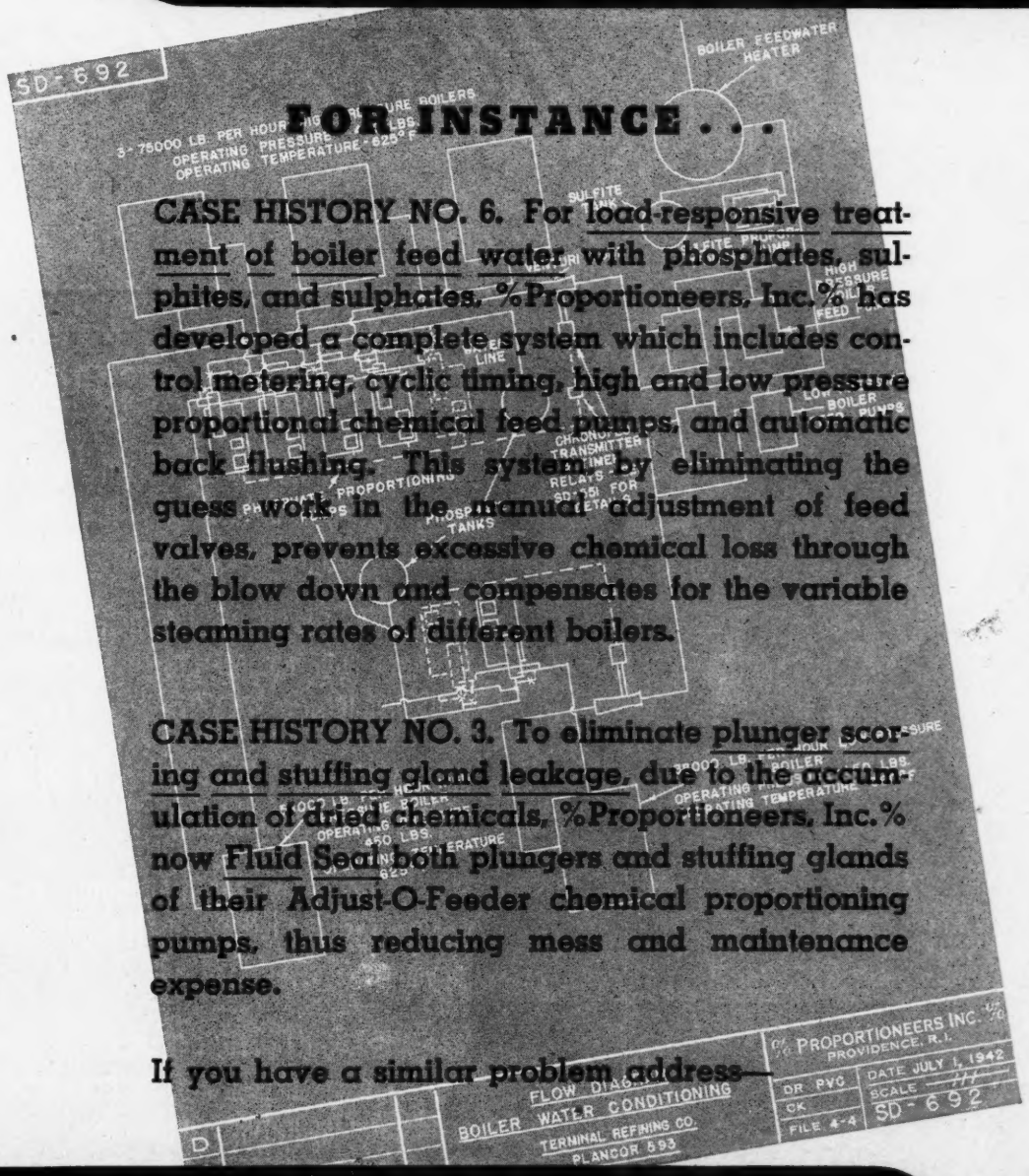

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If you have a similar problem address—

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More steam

HAGAN CONTROL ASSURES –

+ MAXIMUM quantity of steam from any given plant, by introducing fuel and air in correct proportion for utmost efficiency.

+ MAXIMUM utilization value, uniform steam pressure and temperature, in accordance with demand.

+ MAXIMUM output from boilers of differing capacities, automatically.

+ MAXIMUM steam for production, by reducing loss of steam in frequent soot blowing.

+ MAXIMUM PROTECTION of auxiliary equipment, fans, stokers, etc. by maintenance of uniform operating conditions.

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NOTHING in steam boiler equipment is more important to the constant carrying of a war load than AUTOMATIC COMBUSTION CONTROL. It must be adequate, reliable, able to take from your shoulders the responsibility for constant attention . . . to give the utmost freedom from manual adjustment. It should be dependable even if you had to go away in an emergency and leave it.

HAGAN AUTOMATIC COMBUSTION CONTROL will give you that kind of service. It will give it under the most trying conditions. It will assure you instant functioning with the slightest changes in steam header pressure. Since it is *air operated,* Hagan Control assures fast, positive action and remarkable freedom from trouble. Hagan Control installations set up years ago are giving the same excellent service they did in the beginning.

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The ability of the new rust-preventive Shell Turbo Oil to stand up under these extreme conditions at sea assures top performance in *your* turbines. For new, proved, service-tested Shell Turbo Oil has not just one or two, but all three characteristics vital to modern turbine lubrication:

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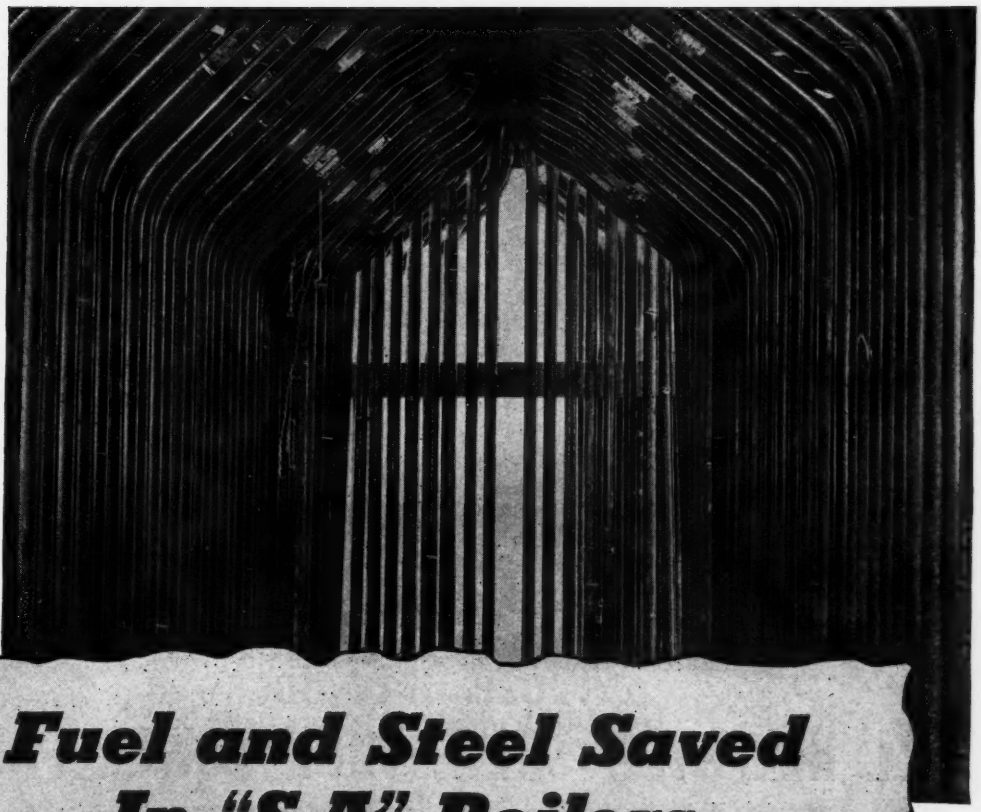

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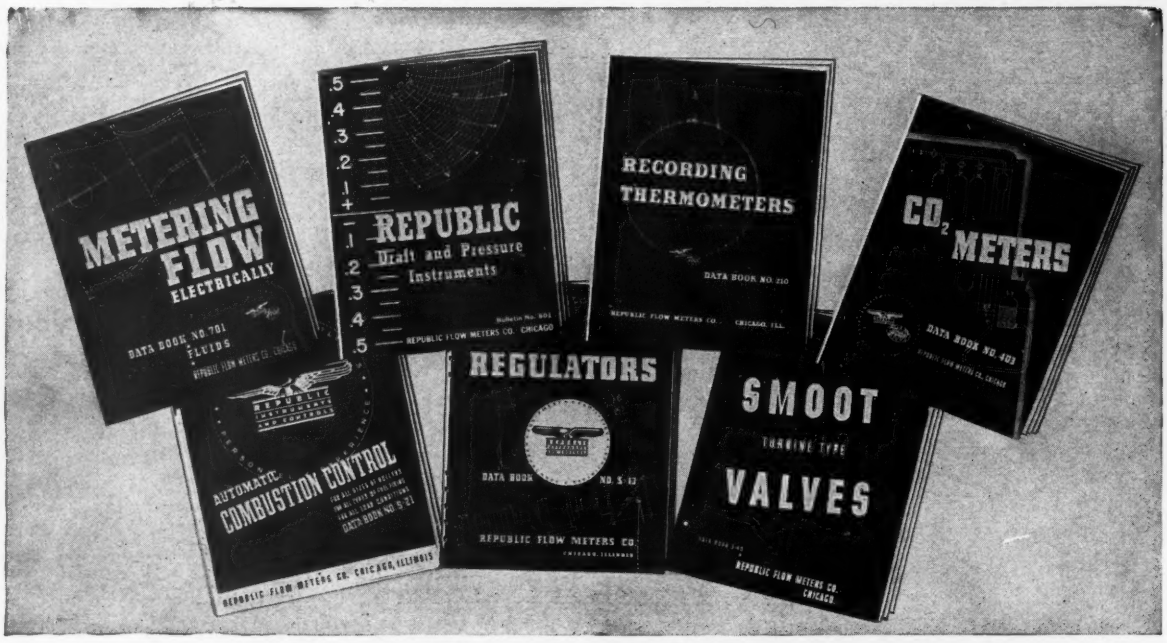


These Data Books
WILL HELP YOU SOLVE YOUR POWER PROBLEMS

Write for these data books now. When your increased power load demands the installation of new units or the "stretching" of existing plant capacity, you will need this information.

REMOTE READING FLOW METERS—Data Book No. 701
For measuring flow of steam generated by each boiler and the total produced; steam consumed by prime movers and process steam consuming units; water supplied to boilers and pumped to processes; rate of generation, distribution and consumption of natural gas, coke oven gas, compressed air and the like; flow of fuel oil, brine, black liquor and so on; the Republic electrical type flow meter with remote reading instruments, as described in this book, is available.

MECHANICAL FLOW METERS—Bulletin No. 110
When it is desired to measure flow of steam, water, gas, air or oil for the same purposes as outlined above but where remote registration is not required, the Republic mechanical ring-balance meter described in this book is available. Since it may be built for differentials as low as 3 in. of water, it is ideal for low-pressure gas and air.

DRAFT AND PRESSURE INSTRUMENTS—Bulletin No. 801
Proper regulation of draft is one of the most important requirements in obtaining highest combustion efficiency. For indicating and recording drafts, pressures and differentials, Republic indicators and recorders, described in detail in this bulletin, are supplied in any desired combination for all ranges encountered in furnace operation.

RECORDING THERMOMETERS—Data Book No. 210
Measurements of temperature of flue gas, temperature in vats or tanks, pipe lines, refrigeration systems, ovens, kilns or ducts and so on, are vital in maintaining highest capacity and efficiency in power plant and process equipment. Republic recording thermometers for this service are described in this data book.

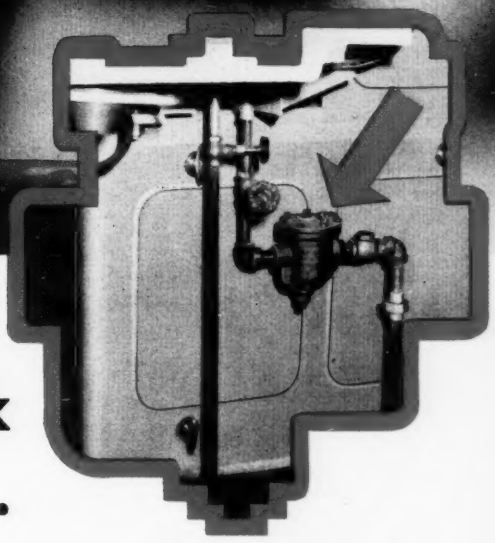
CO_2 METERS—Data Book No. 403
For every fuel and boiler, there is a definite percentage of CO_2 in the flue gas that will assure highest combustion efficiency. The CO_2 meter is the most practical method of determining combustion efficiency. The construction and operation of the Republic CO_2 meter are described in detail in this book.

REGULATORS—Data Book No. S-13
Control of rate of flow of liquids and gases, level of liquids, speed of turbines, engines and motors and proportions between variable pressures and flows must be accurate if maximum plant efficiency is to be attained. These factors are controlled by operation of valves, dampers, rheostats, etc. For sensitive, fast, stable and powerful automatic control of these devices, the Republic-Smoot regulator has been developed. Its construction, operation and applications are described in this book.

AUTOMATIC COMBUSTION CONTROLS—Data Book No. S-21
Boilers must produce maximum steam output at maximum efficiency. That means constant steam pressure, maximum combustion efficiency, constant and correct furnace draft, desired load division among boilers. Republic-Smoot automatic combustion control systems are built for all sizes of boilers, all types of fuel firing and all load conditions, as described in this book, which includes detailed installation reports giving performance data on outstanding power plants.

WRITE FOR THESE DATA BOOKS TODAY!

REPUBLIC FLOW METERS CO.
2224 Diversey Parkway, Chicago, Illinois



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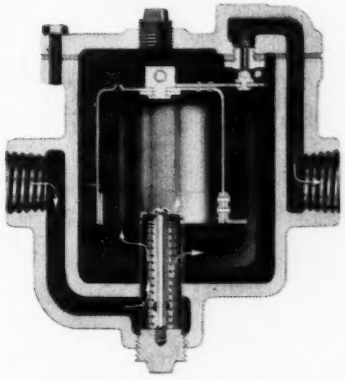
The hurricane blew the top floor of the New England Overall Company to the ground. A rearrangement of machines—plus a speed-up produced by all-Sarco steam traps and controls—enabled this company to do more business with two floors than they formerly did with three.

The owner says:

"I'll Spend a Dollar to Save Ten Anytime.

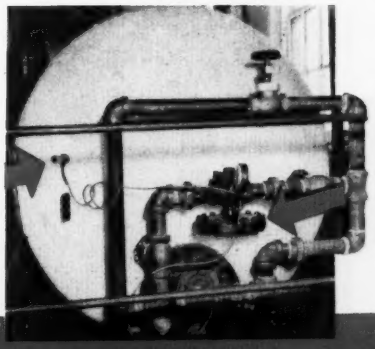
"If you have three wash wheels, you should be able to load them up all at the same time. If your plant is full of presses, pants stretchers, tumblers, etc., no one machine should be slowed up by any or all of the others. Our contractors advised a separate Sarco steam trap for each machine—we know now it would have been folly to do it any other way. Also, instead of putting in an additional hot water tank, they suggested another coil and a Sarco 2430 Regulator which gives us all the water we need and works like a charm. I know what steam costs and what it costs to have operators wait. I'll spend a dollar to save ten anytime."



Sarco Inverted Bucket Steam Traps are available for general application at pressures from 10—900 lbs., and for superheat. Preferred for supply lines to engines, turbines, and pumps, in refineries, laundries and for other hard service where intermittent discharge is permissible.

Catalog No. 350

Sarco 2430 Temperature Regulator

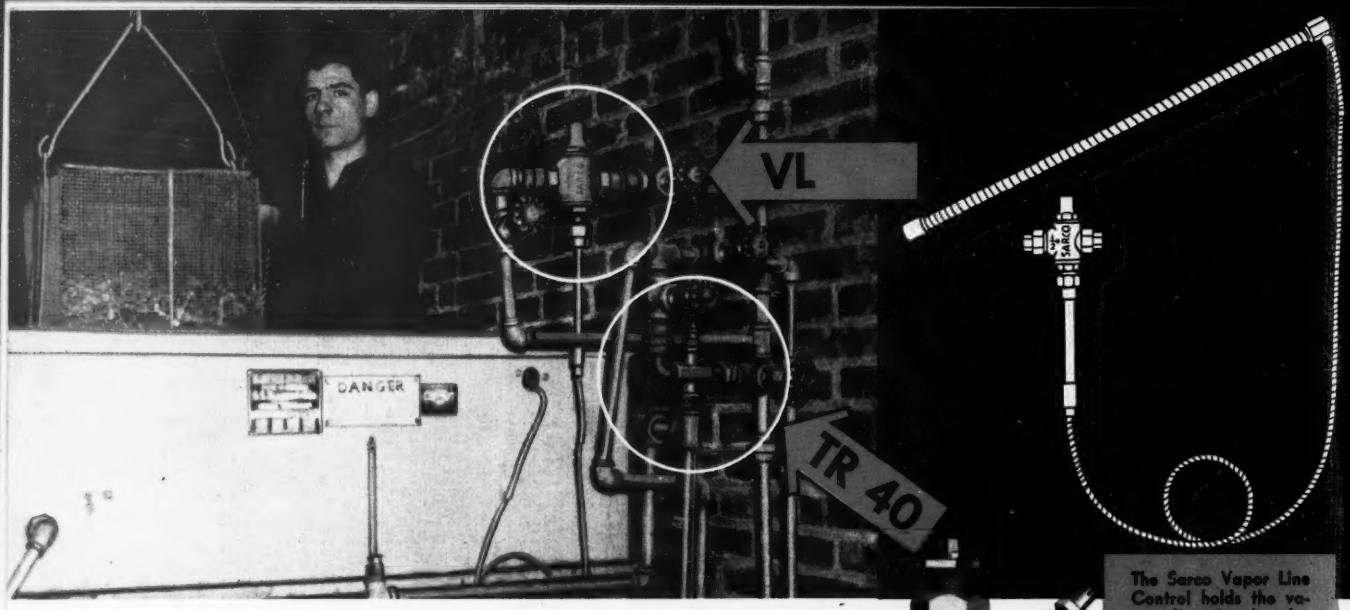


SARCO Saves Steam

SARCO COMPANY, INC., 475 FIFTH AVENUE, NEW YORK

Represented in Principal Cities

SARCO CANADA, LTD., 85 Richmond Street, West, TORONTO, ONT.



The Sarco Vapor Line Control holds the vapor line in the degreaser by regulating the temperature of the cleaning solution.

It is self-operated and requires no compressed air or electricity. The bulb is constructed with corrugated outer surface to secure very rapid response to temperature changes. Catalog No. S930.

More Production with Sarco Heat Controls

Maximum production demands intelligent use of steam so that none shall be wasted.

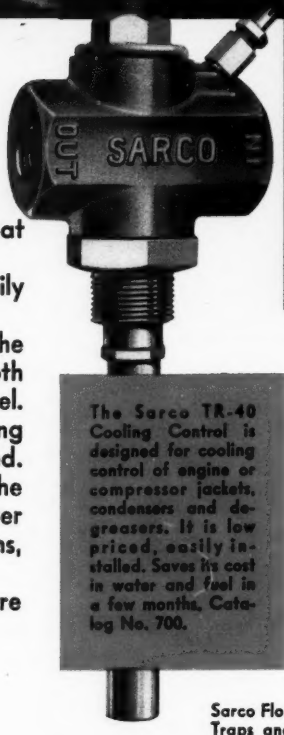
Sarco steam traps and temperature regulators can aid mightily in this effort.

For example, take modern cleaning of metal parts as in the degreaser above. Simple self-operated Sarco valves regulate both heating and cooling coils to keep the vapor at the correct level.

Waste of steam, waste of expensive solution, waste of cooling water, are prevented and a uniformly clean product is assured.

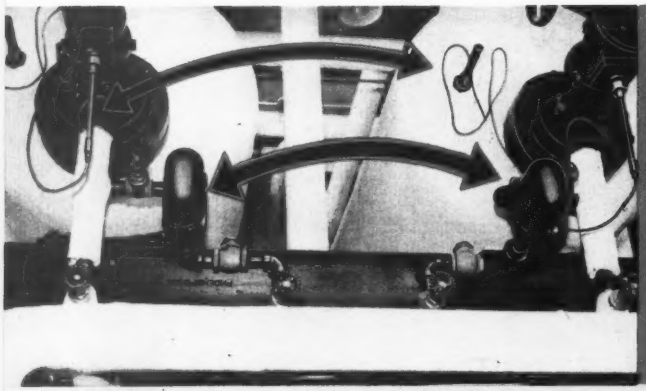
Or, in the simple matter of water heating; without control the water often is too hot and many wasted heat units go to the sewer with it. Fluctuating water temperatures delay process operations, cause rejects, and costly spoilage.

Sarco steam traps assure fast heating and Sarco temperature regulators prevent waste.

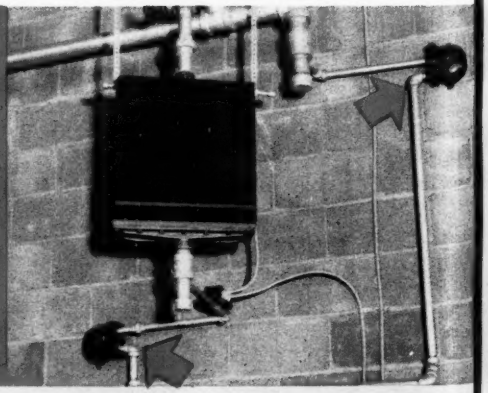


The Sarco TR-40 Cooling Control is designed for cooling control of engine or compressor jackets, condensers and degreasers. It is low priced, easily installed. Saves its cost in water and fuel in a few months. Catalog No. 700.

Sarco Float-Thermostatic steam traps and TR-21 Temperature Controls on hot water service.



FLOAT-THERMOSTATIC STEAM TRAP



Sarco Float-Thermostatic Steam Traps and UL Control on unit heater.

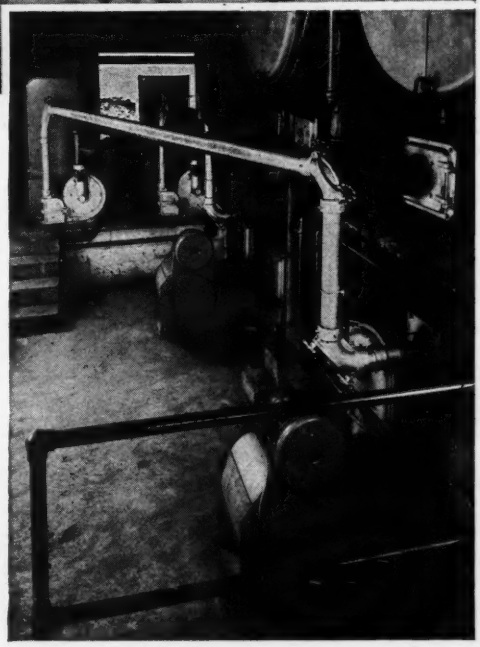
SARCO Saves Steam

SARCO COMPANY, INC., 475 FIFTH AVENUE, NEW YORK

SARCO CANADA, LTD., 85 Richmond Street, West, TORONTO, ONTARIO

Represented in Principal Cities

WACO Doubles Steam Output with Iron Fireman P-S* Stokers



*Pneumatic Spreader Stokers "standard" at Waco Aircraft Plants

PLANES and more planes will win the war . . . and Iron Fireman is supplying more steam for building these planes at Waco. Waco is expanding tremendously to build more training and cargo aircraft. Right now at Waco, a large addition is under construction. Because of Iron Fireman's proved performance, the company *specified* Iron Fireman Pneumatic Spreader stokers to do this new firing job.

Last year in its central plant, Waco installed Iron Fireman P. S. stokers to replace another type of automatic firing equipment which could not carry the steam load for heating and processing. Iron Fireman engineers recommended that two P. S. No. 12 stokers be installed in the existing 195 h.p. boilers. At that same time the plant's capacity was *expanded,* and the company was amazed to find that with P. S. firing *one* boiler could carry the greatly increased load even with weather 15° below. (The smaller original load had been too much for two boilers with the former firing equipment). Also, fuel costs remained the same, although the load is much heavier.

S. R. Murphy, Waco maintenance foreman, says: "The ease of operation and flexibility of P. S. stokers are outstanding."

The position of the two Pneumatic Spreader stokers at the Waco plant illustrate the flexibility of P. S. installations. Here both hoppers are located side-by-side within the enclosed coal bin. This facilitates loading and keeping the boiler room clean. The location of P. S. stokers is not confined to the boiler room floor level . . . they can be set at floor level or above or below, to best suit the plant's arrangement.

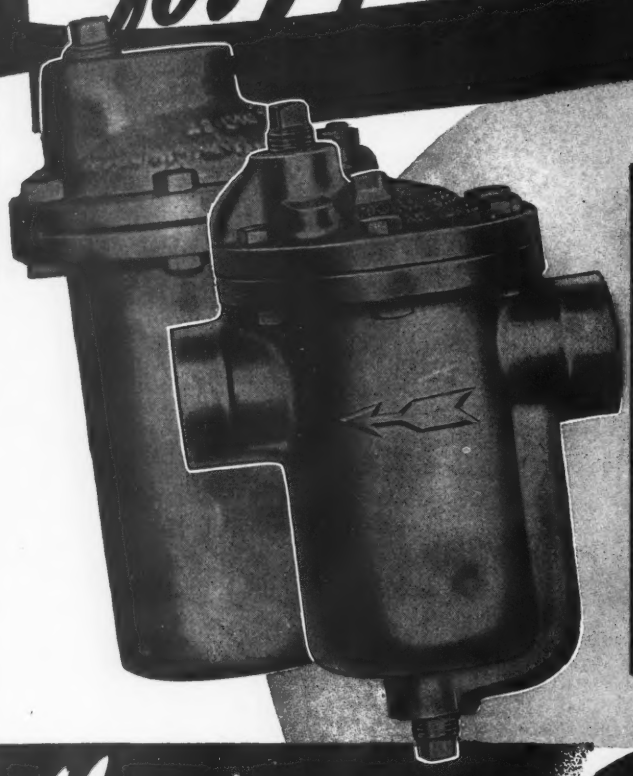
Free Iron Fireman Engineering Survey

Iron Fireman engineers are ready to make a free engineering survey of your boiler plant. For free survey or P. S. catalog, write Iron Fireman Manufacturing Company, 3322 West 106th Street, Cleveland, Ohio.

See our exhibit 15th National Exposition of Power and Mechanical Engineering, Madison Square Garden, New York, Nov. 30-Dec. 4

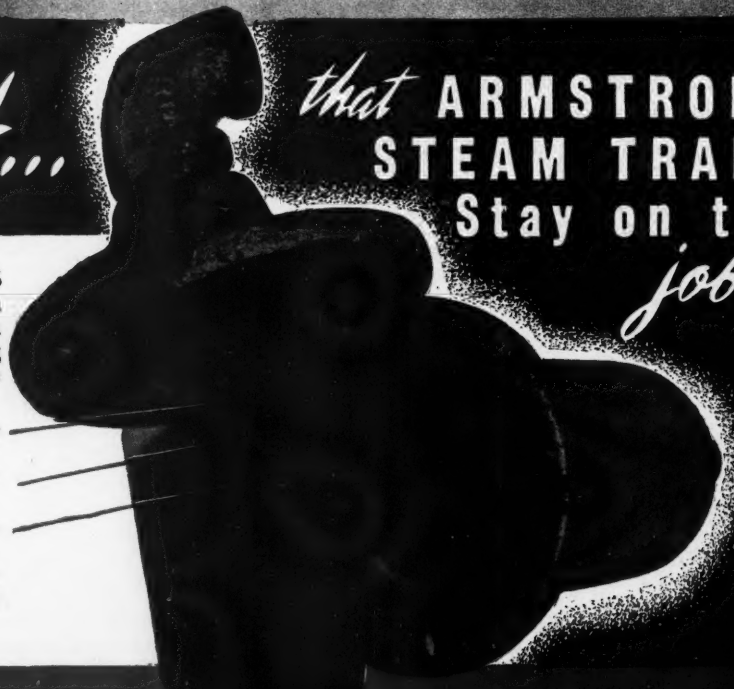
IRON FIREMAN AUTOMATIC COAL STOKERS

TROUBLE WATCHING



FEATURES Operating Engineers want in Steam Traps:	THE ARMSTRONG STEAM TRAP:
1. Ability to draw off air.	✓YES
2. Ability to handle hot condensate.	✓YES
3. Ability to handle all ordinary sediment and sludge.	✓YES
4. Freedom from wire-drawing in orifice.	✓YES
5. No steam loss for any load condition.	✓YES
6. Ability to hold tight against vacuum.	✓YES
7. Freedom from friction and wear.	✓YES
8. Small size—light weight.	✓YES
9. Simple construction.	✓YES
10. Large capacity.	✓YES

Here's proof... that ARMSTRONG STEAM TRAPS Stay on the job!



THIS picture shows how from 1/16 to 3/16 of an inch of hard scale was deposited on the inside of the body and cap as well as on the working parts of a No. 212 Armstrong Trap before cleaning was necessary. Note particularly the following:

1. Bright line on valve which shows that valve parts were working.
2. Scale broken from bucket hook to indicate thickness of scale.
3. Scale around bucket vent but the vent was still open.

It takes an Armstrong free-floating lever trap to operate for long under such bad water conditions!

Saving Fuel, Metals and Manpower for the Battle of Production

ARMSTRONG

endless waste

1. Use Armstrong Steam Traps
2. Install Them Properly
3. Inspect Them Regularly

AMERICAN Industry has been exhorted to "patch and pray" to keep war production rolling in face of tremendous obstacles—shortages of equipment, materials and manpower.

Armstrong Steam Traps can help you meet this challenge.

1. USE ARMSTRONG STEAM TRAPS:

To Conserve Fuel — Records show such savings as a ton of coal per day, 12 gallons of fuel oil per hour, $2500 worth of fuel per year.

To Reduce Maintenance — One plant saves 19 days per month of one man's time on trap and piping maintenance since installing Armstrongs; others report trap maintenance reduced as much as 95%.

To Eliminate Need for More Boilers — A considerable number of plants, on the point of ordering new boilers, have found that Armstrong Traps will enable existing boilers to do the work.

To Speed Up Heating — Users' reports show 30% less time to bring jacketed kettles to a boil, 20% more output from equipment with unit trapping and similar production-increasing advantages.

2. INSTALL THEM PROPERLY — This is essential to the securing of maximum benefits. It's made easy by Armstrong side inlet and bottom inlet styles, by practical condensate drainage data in the Armstrong Steam Trap Book and by full cooperation of Armstrong Representatives.

3. INSPECT THEM REGULARLY — An easy, quick job. The cap carries the works—just remove it. Repairs are simple and fully explained in Armstrong literature, but seldom required. "10 years service with no repairs," reads one report; 6/100 of a cent per trap per year over a five year period is the maintenance cost in another plant.

Take advantage of what Armstrong Traps can do to help you win the war. See your local Armstrong Representative, or write.

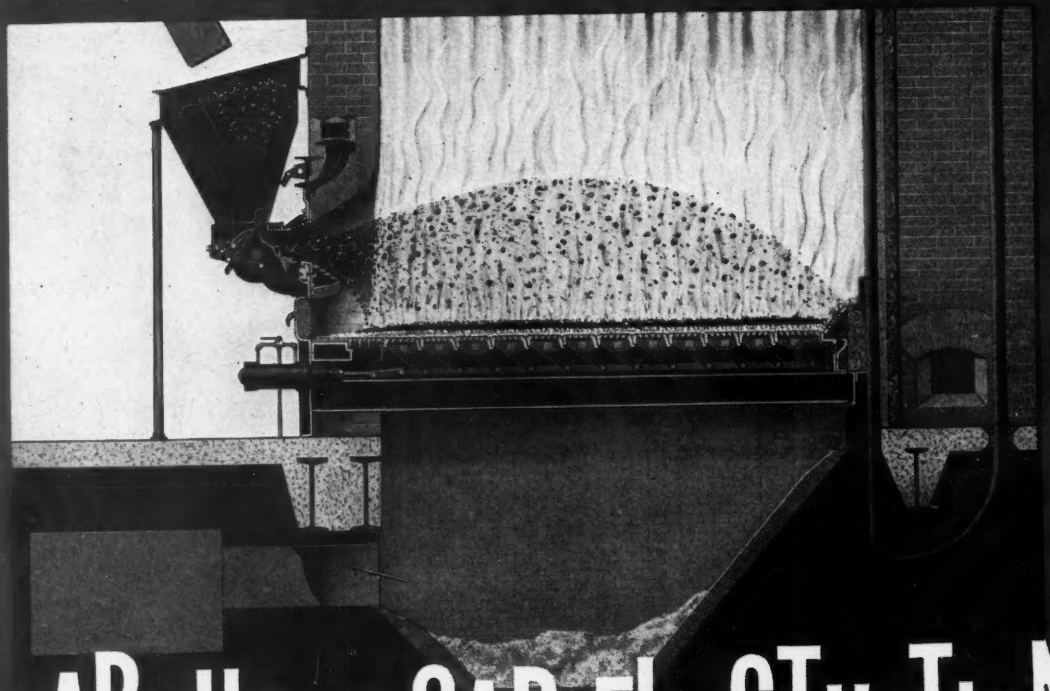
ARMSTRONG MACHINE WORKS
810 Maple Street, Three Rivers, Michigan

SEE OUR CATALOG IN SWEET'S

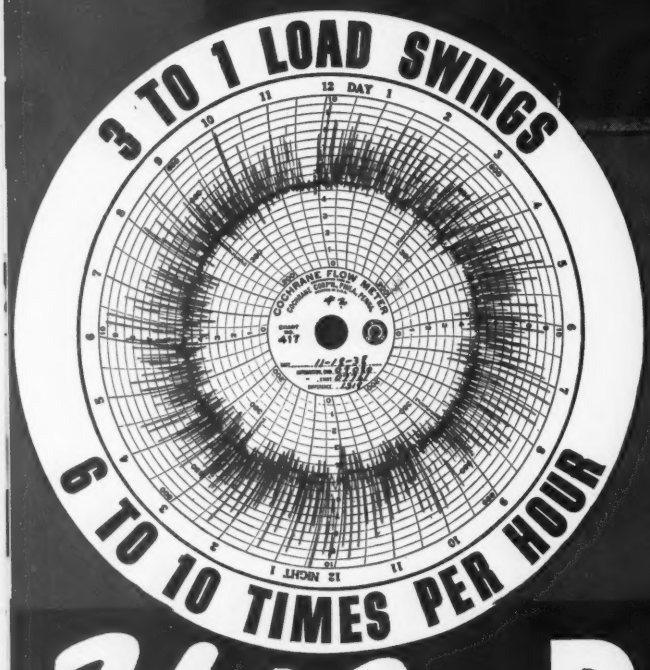
this **BULLETIN** *is designed to help plant maintenance engineers get maximum life and efficiency from their traps. Write for your copy.*

Tested Capacity STEAM TRAPS

FOR HIGHER CAPACITIES



AND ABRUPT LOAD FLUCTUATIONS



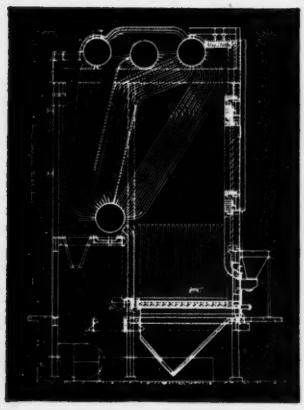
RotoStokers develop high capacities. Fluctuating loads are successfully handled because of rapid burning of the fuel with extra turbulence in the furnace. Coal feed and air supply are accurately controlled so that extreme fluctuations in load are carried by the unit, with uniform pressure maintained. • *Write for Bulletin No. 830.*

DETROIT STOKER COMPANY

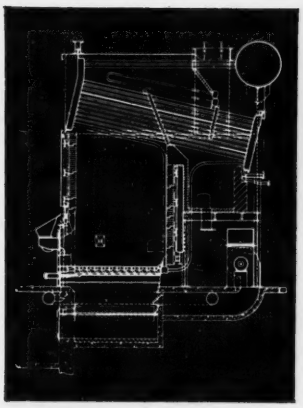
Sales & Engineering Offices

General Motors Building • Detroit, Michigan

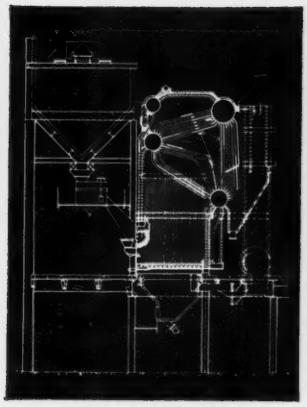
Use DETROIT



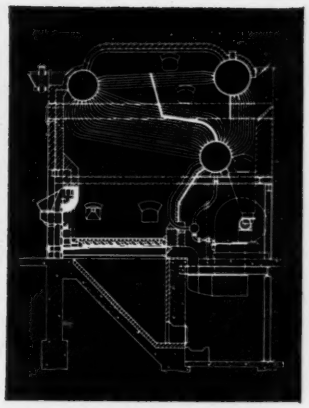
75,000 pounds steam per hour — Pennsylvania Coal.



30,000 pounds steam per hour—Southern Illinois Carbon Coal.



300% normal rating—West Virginia Coal.

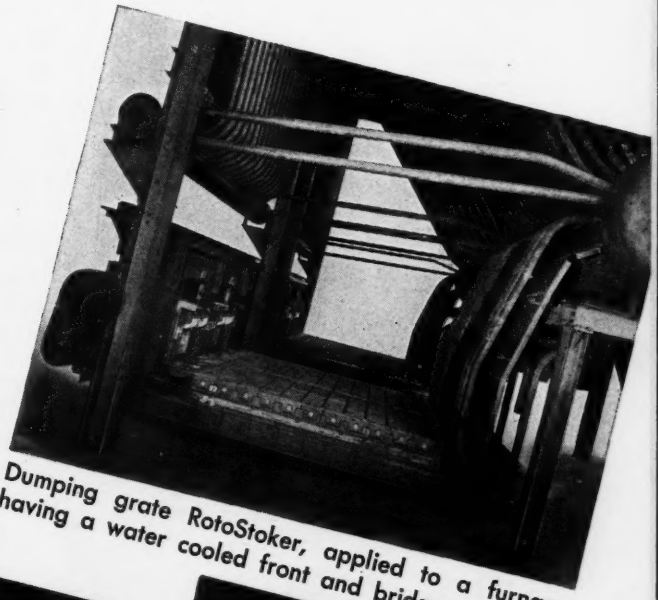


Iowa Municipal Plant — burns local Iowa screenings.

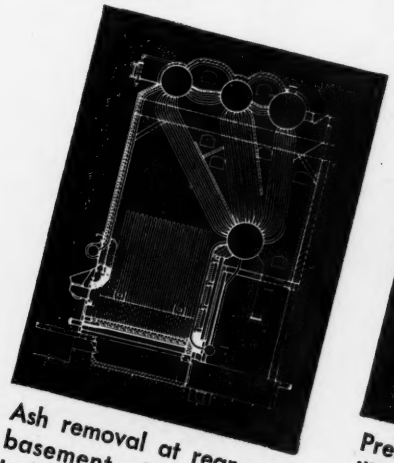
Burn a wide variety of fuels with a wide range of boiler types and sizes

ROTOSTOKERS OPERATE SUCCESSFULLY WITH:

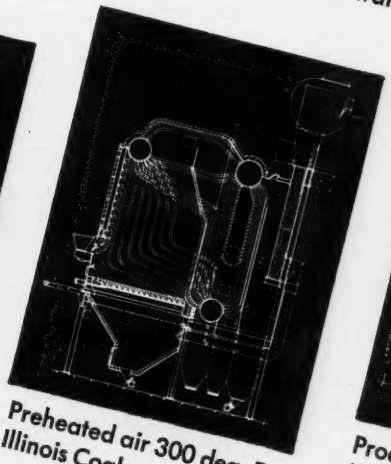
- *Uniform Fuel Distribution*
- *Thin, Porous Fuel Bed—No Agitation*
- *High Burning Rates with Fuels Having Ash of Low Fusing Temperature*



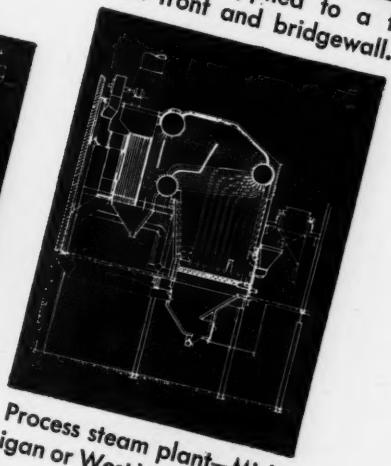
Dumping grate RotoStoker, applied to a furnace having a water cooled front and bridgewall.



Ash removal at rear — no basement — Eastern Kentucky Coal.



Preheated air 300 deg. F.— Illinois Coal.

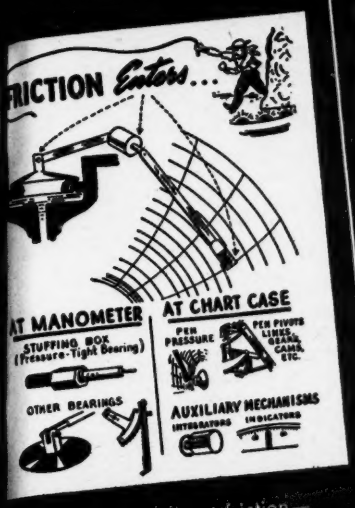


Process steam plant—Michigan or West Virginia Coal.

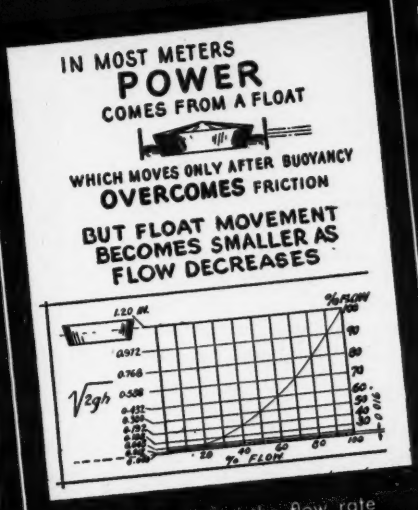
ROTOSTOKERS

Gauging Flow Meter A
Let's Consider an IDEAL FLOW METER
We would look for 4 POINTS
HIGH ACCURACY
LOW MAINTENANCE,
READABILITY, and
ADAPTABILITY TO VARYING CONDITIONS
1. Accuracy is the No. 1 consideration.
MOST METERS MEASURE FLOW THRU THE VELOCITY HEAD
Produced by
ACCURACY DEPENDS ON HOW WELL THIS U HEAD IS TRANSLATED TO THE
and
2. Accuracy depends on what's between the orifice and the chart.
IN ALL METERS...
FRICTION MUST BE OVERCOME
POWER MUST BE DELIVERED TO PEN
HIGH ACCURACY = POWER / FRICTION
3. Here then is the basic standard... POWER / Friction
The COCHRANE METER
... Approaches This Ideal
Let's See How!
7. Well, let's see how we do it.
COCHRANE FLOW METER
STARTS with a FRICTIONLESS TRANSMITTER
FRICTIONLESS FLOAT IS PILOT FOR
% FLOW
ENDS with HIGH and EQUAL POWER AT EVERY POINT THRUOUT SCALE
8. Exactly as the ideal requires, the motor supplies high power from 0-100%...
COCHRANE FLOW METER
Gets its accuracy from BASIC DESIGN
MEASURING CIRCUIT
BALANCED BY ALL WORK
FRICTION FREE Transmitter
SENSITIVE DETECTOR (Galvanometer)
POWERFUL Balancing & Recording Mechanism
In Accordance with The NULL Method
UNIVERSALLY RECOGNIZED AS THE ... METHOD OF PRECISION MEASUREMENT
9. because in this NULL system the circuit does no work.

Accuracy



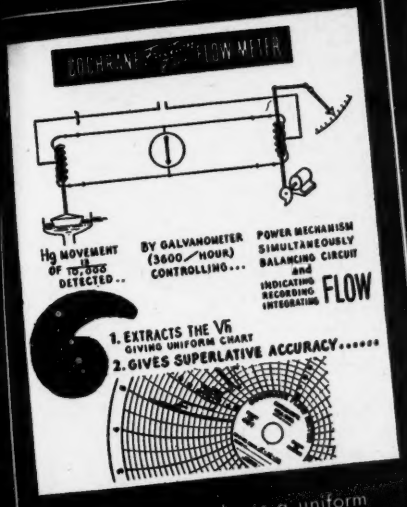
4. No meter is without friction—and some have considerable.



5. And the lower the flow rate the smaller the power ($\sqrt{2gh}$)

In the Ideal METER
MANOMETER FRICTION IS ELIMINATED
CHART (CASE) FRICTION IS DWARFED BY HIGH AND EQUAL POWER THRUOUT SCALE
% FLOW
Remember HIGH ACCURACY = POWER / FRICTION

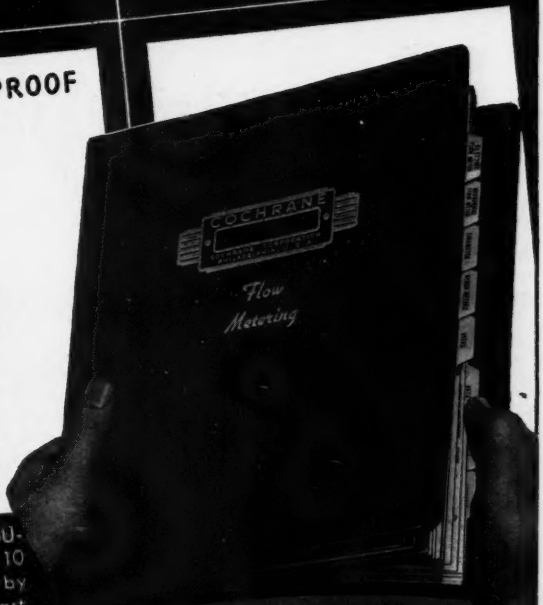
6. Note well we want high and equal power from 0 to 100% flow.


COCHRANE FLOW METER
Hg MOVEMENT OF 1/8000 DETECTED..
BY GALVANOMETER (3600/HOUR) CONTROLLING...
POWER MECHANISM SIMULTANEOUSLY BALANCING CIRCUIT and INDICATING RECORDING INTEGRATING
FLOW
1. EXTRACTS THE $\sqrt{h}$ GIVING UNIFORM CHART
2. GIVES SUPERLATIVE ACCURACY.....

10. The cam produces a uniform chart AND superlative accuracy because...

AND AS VISIBLE PROOF
EACH Cam Shaped to exactly record water column differential thruout scale
Note: ENTIRE Absence of friction Lag 10 to 100%

11. each cam is INDIVIDUALLY calibrated at 10 test points as shown by the final record chart.



12. Ask us to tell you the complete story covering also Maintenance, Readability, and Adaptability.

COCHRANE

3100 N. 17th STREET PHILADELPHIA, PA.

Swartwout Controls help you keep vital power service flowing *with Safety Efficiency and Economy*

● For many years, Swartwout customers (doubtless you are one of them) found they could depend upon the design, engineering and construction of Swartwout Controls for unusually reliable service under toughest power plant conditions. Today's developments in these products add extra safety and efficiency, with low maintenance features that mean economy in time and money. . . . Swartwout standards have always been high; Swartwout progress continues to embrace the latest techniques, materials and processes. Cooperation with your consulting engineers is complete, and special adaptations are made to fit their interpretation of your needs. . . . Your nearest Swartwout Representative will gladly check your problems with you and explain how Swartwout can serve you with experience gained in 38 years of power plant equipment manufacture. . . . THE SWARTWOUT COMPANY, 18501 Euclid Avenue, Cleveland, Ohio

Swartwout
•Power Plant Equipment•

SWARTWOUT
Power Plant Equipment

- Feed Water Regulators
- Pump Governors
- Liquid Level Controls
- Pressure Control Valves
- Desuperheaters
- Desuperheater Governors
- Differential Pressure Master Regulators
- Feed Water Heaters
- Drainage Systems
- Steam Separators
- Air Separators
- Exhaust Heads

UNIT RESPONSIBILITY
Swartwout handles the complete problem of Feed Water Control or of Reducing and Desuperheating, assuring fully satisfactory results.

Get quick help from nearest representative

ALBANY NEW YORK
P. F. Chartres
ATLANTA GEORGIA
P. H. Nichols
BUFFALO NEW YORK
Howard S. Schall
CAMBRIDGE MASS.
George H. Thomson
CHICAGO ILLINOIS
L. V. Warner
CINCINNATI OHIO
Henry O. Hill
CLEVELAND OHIO
Stephan Company
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COLUMBUS OHIO
W. C. Roseberry
DAVENPORT IOWA
Guilford Darby Scholl
DENVER COLORADO
Hendrie & Bolthoff Mfg. and Supply Co.
DETROIT MICHIGAN
R. G. Van Sickle
HOUSTON TEXAS
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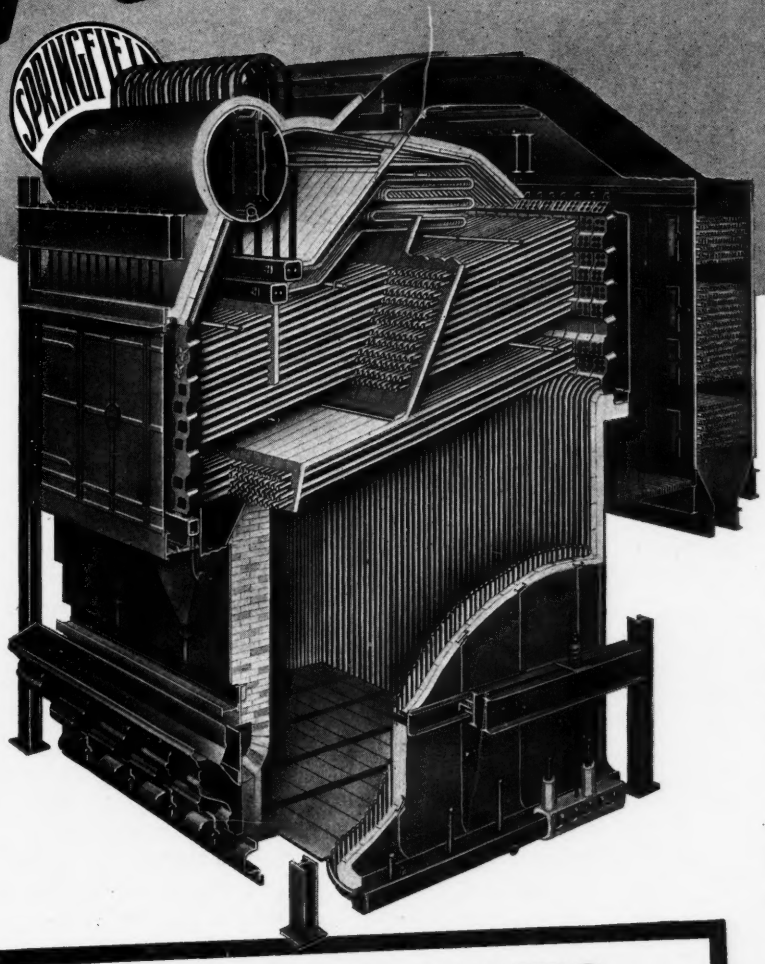
HUNTINGTON W. VA.
H. Y. Keeler
INDIANAPOLIS, INDIANA
E. J. Clerget
KANSAS CITY MO.
Smiley Equipment Co.
LOS ANGELES CALIF.
C. P. Crowley
LYNCHBURG, VIRGINIA
Campbell King, Jr.
MILWAUKEE VIS.
Arno N. Dietze
MONTREAL QUEBEC
Dominion Flow Meter, Ltd.
NEW ORLEANS LA.
George Keller
NEW YORK CITY N. Y.
H. S. Fraser
ORANGE, NEW JERSEY
J. W. Johnson
PHILADELPHIA PA.
William F. Hawk
PITTSBURGH PA.
James Hood Miller
ROCHESTER N. Y.
Arthur W. Schuster
SAGINAW MICHIGAN
W. A. Witheridge
ST. LOUIS MISSOURI
Foster Mechanical Equip't Co.
Midwest Machinery Co.
ST. PAUL MINNESOTA
Fuel Economy Eng. Co.
SALT LAKE CITY, UTAH
Lee, Pace & Turpin
SAN FRANCISCO, CALIF.
A. C. LoPrest & Co.
SYRACUSE, NEW YORK
John B. Foley, Jr.
TORONTO ONTARIO
Dominion Flow Meter, Ltd.
VANCOUVER B. C.
Frank Sawford
WASHINGTON D. C.
T. W. McGuire Company
WAVERLY (Scranton District) **PA.**
Frank W. Hoyt

POWER is needed NOW!



HERE'S HOW SPRINGFIELD HELPS GET PLANTS *Going Sooner!*

FIELD records on war plant construction show that Springfield boilers can be *installed 30 to 60 days sooner* than other types! This speed up is made possible primarily by exclusive features of Springfield design:

Shop Assembled Sections. Sections of 3" tubes rolled into electric cast steel headers are assembled complete with baffles in our shop saving weeks in field construction. Water walls also shop assembled where field conditions permit.

Each section is hydrostatically shop tested at pressures at least 50% over working pressure and never less than 500 lbs. Springfield's distinctive 4-tube grouping arrangement, combined with sinuous headers give each section rigidity and strength to withstand handling in shipping and in the field.

Complete 90% of Installation Before Single Drum Arrives. Delays in getting steel plates for drums is a minimum retardant on Springfield jobs. The setting can be put in, tubes, headers, water walls, auxiliaries installed—all before the drum arrives for connection. And Springfield's single drum design requires considerably less critical steel than multiple drum designs.

Delivery. Springfield shops are not loaded up with mass production of standardized boilers. Prompt attention can be given to units to meet the most special needs. Ask for further facts, now. SPRINGFIELD BOILER CO., 1951 E. Capitol Ave., Springfield, Illinois.

DUPLICATE UNITS
SAVE ENGINEERING AND SHOP TIME

Complete drawings, patterns, shop fixtures, etc., are on hand to duplicate any of the many modern Springfield steam generating units built in recent years. Capacities from 5,000 lbs. to 450,000 lbs. per hour, or more. Pressures from 75 lbs. to 750 lbs., or higher. Springfield regularly takes contracts for complete steam generating units.

SPRINGFIELD

STEAM GENERATING UNITS

SPRINGFIELD BOILERS

ANY SIZE ANY FUEL ANY PRESSURE

HOW TO MAKE YOUR SPREADER ... with less outage and lower maintenance

If yours is one of the many plants operating Spreader stokers, here are some suggestions that will help you get longer life out of your present equipment and minimize outage for repairs or replacements. While they relate primarily to the C-E Spreader Stoker illustrated here, they are largely applicable to all stokers of this general type.

If this information is not of immediate interest to you, please see that it reaches the proper man in your organization.

OPERATION

GENERAL The two main causes of excessive outage and maintenance are (1) sustained or frequent overloading of stoker and (2) operating with insufficient draft resulting in positive furnace pressure.

Where prolonged overloading is unavoidable, as is often the case in these days, good operation and careful attention to maintenance are especially important. Frequently, in such cases, the use of a higher quality coal will make it possible to carry the increased load without excessive outage or maintenance costs.

Where difficulties are due to insufficient draft, the suggestions made under the heading "Draft" may prove helpful.

FIRE (1) Good performance and low maintenance originate primarily in the fuel bed. Keep it level and thin with little more than a minute's supply of coal on the grate. This may be checked easily by shutting off the coal feed with the forced draft on—the fire should be ready to dump in about one minute. A heavy fire will smoke and form clinkers. Clinkers frequently cause burned and broken grate sections.

(2) Adjust distributor speed and circular tray so that coal will feed evenly over the entire grate area. A heavy fire at the bridge wall will not only form clinkers but will cause excessive erosion of brickwork. A heavy fire at the front tends to overheat the arch, piers and distributing mechanism and may injure the stoker front. Always check feeder speed adjustment when character of fuel is changed in type, size or moisture content. Adjust *air supply* to suit every change in *fuel supply*.

(3) Avoid, as far as possible, the use of coal having lumps over 1¼ in. in size; ¾ in. nut and slack is the preferable size. The coarser sizes cause excessive wear on feeder and distributor mechanism and tend to overload and clinker the fuel bed. Under emergency conditions, if difficulty is experienced in getting coal of proper size, it may be necessary to use a screen above the stoker hopper to keep large lumps of coal out of the feeder.

(4) Keep an ample supply of coal in hopper—not less than half full—at all times during operation. ***Avoid segregation of coal sizes in hopper.*** Wherever possible use mechanically-operated swinging spout, traveling larry or non-segregating spreader chutes.

(5) Clean fires and ash pits at regular intervals, preferably twice each shift. This keeps fires in good condition, ready to handle load swings. Accumulated refuse in ash pit may cause damage to grates and grate mechanism.

(6) When banking a spreader stoker fired unit, be sure to leave a layer of ash on the grate to protect it. Cut down air supply, reduce distributor speed and feed in coal for banking on front end of stoker only. Then cut off forced draft and stoker feed. Maintain slight draft over fire.

DRAFT (1) Draft gage and a CO_2 indicator are essential to good operation.

(2) Operate with a draft above fuel bed—preferably .10 in., not less than .05 in. Plus pressure causes overheating which is destructive to grates, brickwork and possibly to stoker mechanism.

(3) Maintain proper supply of air at all times. Too much or too little air will reduce efficiency and capacity. Insufficient air will cause smoke.

(4) Some air should be allowed to pass through grates at all times except when fire is banked.

(5) Don't force stoker beyond capacity of stack to carry away gases. (See (2) above.)

(6) Keep undergrate zones and side frames sealed to prevent air leakage between zones and into furnace.

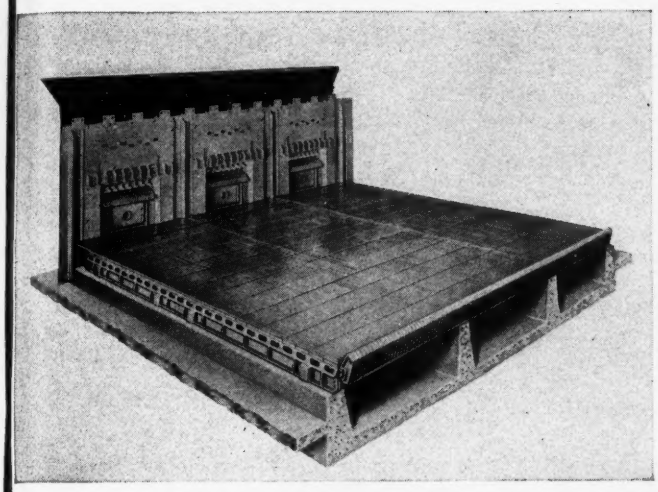
(7) If draft is insufficient, check leaks in setting and losses through boiler and flue connections; check position of boiler damper. Careful checking will usually disclose conditions that can be improved.

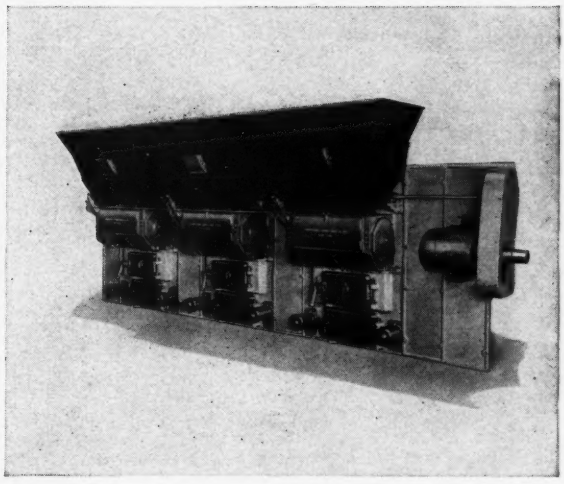
CLEANING (1) Clean equipment lasts longer.

(2) Keep stoker exterior clean to prevent contamination of lubricants and excessive wear of moving parts. Use compressed air or steam hose to remove grease and coal dust—they may catch fire and damage the mechanism.

(3) Check and clean the cinder disposal or recovery equipment regularly. Keep collection hoppers clean to avoid fires.

STOKERS LAST LONGER...





C-E Spreader Stokers, illustrated above, have been applied to all types of boilers ranging in capacity from 4000 to 175,000 lb. of steam per hr.

INSPECTION & MAINTENANCE

(1) Inspect all accessible parts of stoker daily, and examine stoker completely when shut down—at least twice yearly.

(2) Replace broken grate sections promptly to prevent excessive sifting loss. Allow clearance between grate elements when assembling to avoid damage due to their natural growth under heat.

(3) Inspect mechanism occasionally for wear on gears, condition of bearings, alignment and lubrication. Tighten loose nuts.

(4) Keep belts, pulleys, chains and sprockets lined up and adjusted to proper tension. A slack chain will whip and wear excessively. A loose belt will slip and overheat. Chains and belts that are too tight cause excessive wear on shafts and bearings. Keep chains clean and well lubricated. Keep belts clean and free of oil or grease.

(5) Use only recommended shear key. The substitution of other material may result in overloading or breakage of stoker mechanism.

LUBRICATION

Lubricate all points requiring lubrication on a definite schedule. Use the correct grade of lubricants. Give particular attention to the drive mechanism. Flush and clean gear case at least once a year. Refill to correct level with new oil of proper grade. Adequate lubrication is inexpensive insurance against outage and excessive maintenance.

The C-E line of stokers is the most extensive on the market. It includes single retort, multiple retort, spreader, traveling and chain grate types.

OVER 17,000 C-E STOKERS HAVE BEEN PURCHASED TO DATE

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A-691

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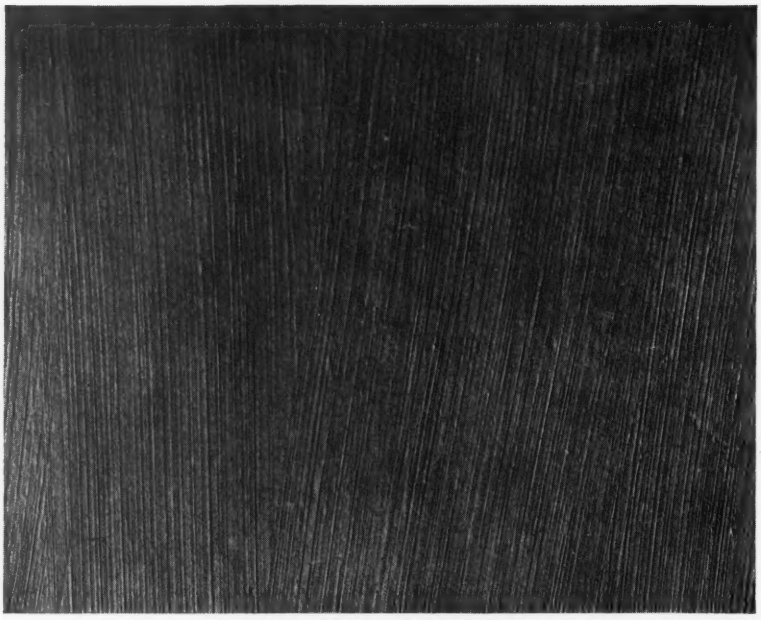

APEXIORIZED Boiler Metal

APEXIOR Protection Renews Old-Boiler Life

These days there's no argument about renewing all wearable materials for longer service. More so with steam boiler and turbine equipment — new installations don't come with a phone call. Your boiler metal positively must stand wear and tear for — who knows how long?

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As a supplementary protection with feedwater treatment, APEXIOR has been known and used for many years by power engineers who insist on peak efficiency and good housekeeping.

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Write for Bulletin 1290

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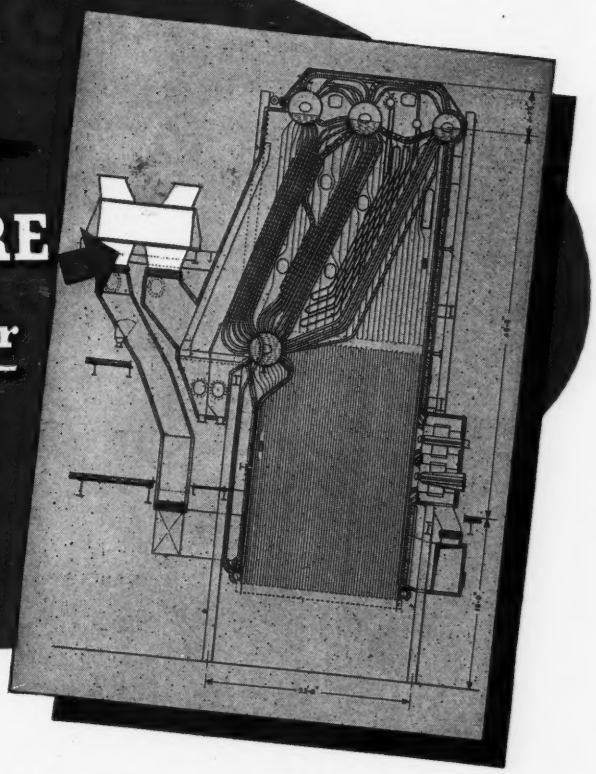
HEAT SAVED HERE
Means More Fire Power
At the Front



Ten new boilers like this at ordnance plants save fuel and steel with Ljungstrom Air Preheaters

Typical of the steam generating units being installed at a group of plants for munitions manufacture is this 135,000-lb.-per-hr. boiler, fired with powdered coal. Flue gases enter the Ljungstrom Air Preheater at 665 deg. F., leave at 351 deg., heating combustion air to 502 degrees.

• • • • •

Power plants that mean more fire power for American arms must go up fast, and then stay on the job without shut-downs. Yet conservation is as important here as elsewhere... every needless pound of steel must be spared, and every pound of fuel s-t-r-e-t-c-h-e-d by efficient combustion and maximum heat recovery.

For all these reasons, the uniform type of the steam generator chosen for this group of plants is equipped with the Ljungstrom Air Preheater.

The *continuous regenerative counterflow* principle of the Ljungstrom greatly reduces its size and weight, often saving one-half the steel that would otherwise be required for the same heat recovery. Erection is simplified, the preheater reaches the job as a completely fabricated unit. Further material savings are made in the supporting structure.

If you are faced with a problem of wartime power generation, or any need for gas-to-air heat transfer at temperatures to 1400 deg. F., be sure to check the *conservation features* of a Ljungstrom. A factual booklet, "Another Kind of Air Power with a Wartime Job to Do", tells the story. Write for a copy.

THE

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CORPORATION

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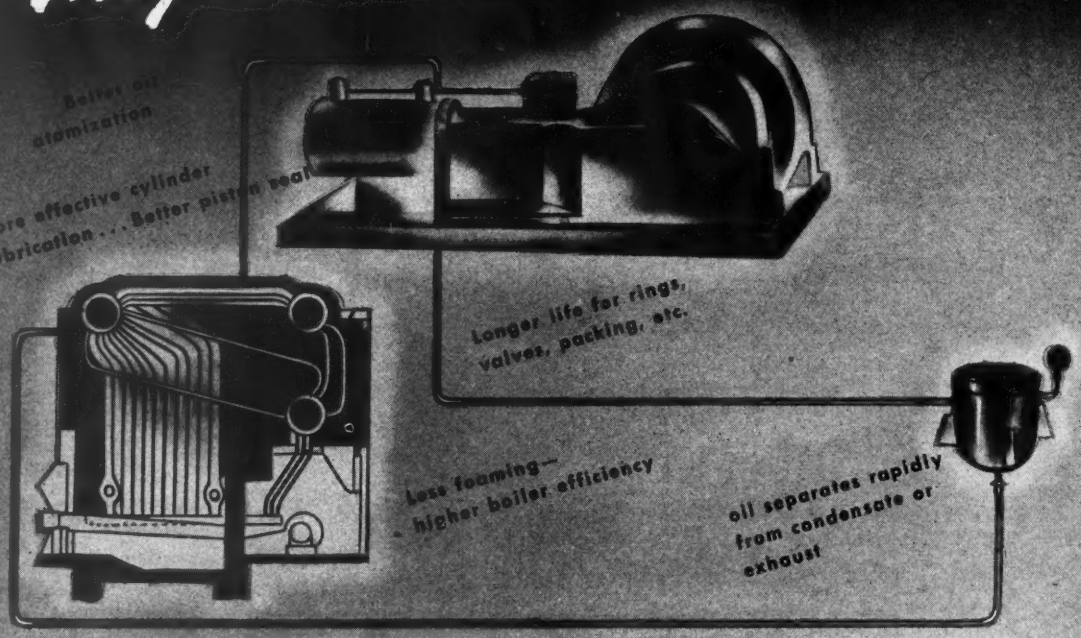
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More effective cylinder lubrication . . . Better piston seal
Longer life for rings, valves, packing, etc.
Less foaming— higher boiler efficiency
oil separates rapidly from condensate or exhaust

DRAFTED for active war duty, hundreds of standby steam engines are being kept on the line . . . delivering full power . . . with the aid of *Texaco Steam Cylinder Oils.*

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TEXACO Lubricants and Fuels

FOR POWER PLANT EQUIPMENT

TUNE IN FRED ALLEN EVERY SUNDAY NIGHT—CBS ★ HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

POWER PLANT ENGINEERING

DECEMBER, 1942
VOLUME 46, No. 12

Cover: Coordinated with an outside power supply, a 1562 kv-a. turbine generator carries load up to 1000 kw. at this industrial plant plus all the wattless load. The ordinary plant load is about 1500 kw. at 79 per cent power factor. Automatic regulators for load, power factor, and current-limiting coordinate the power supply. Westinghouse photo.

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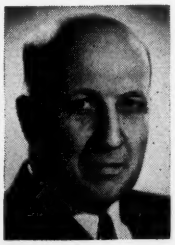
YARWAY IMPULSE STEAM TRAP

WHAT LEADERS SAY

America Is Just Discovering Itself



By GEORGE A. BRYANT

IT HAS taken 450 yr.—1492 to 1942—for the America that Columbus discovered to really discover itself. If Columbus and his crew could have a close-up look inside the America we know, working and sharing confidences with basic war industries from coast to coast, they would see enough to silence our skeptics and cheer our men at arms.

With all of our manpower, industrial resources and inventive genius being harnessed to a single objective, we are flexing our minds and muscles to their full extent for the first time in the history of the country. With all our hard won spiritual, cultural, social and material gains in jeopardy, Americans everywhere are fast waiving their claims to things that stand in the way of all-out prosecution of the war.

The producers of our basic raw materials, riding over their fears of postwar surpluses, have reset their sights with realistic recognition of the job immediately at hand. Bigger and richer mines are coming in along the Lake Superior ranges and in the long neglected eastern ore fields which supplied the iron used to arm our Revolutionary heroes in 1776. New blast furnaces and open hearths are being built to supply the ever increasing need for steel. Hydroelectric, steam and Diesel generating plants are producing more and more power to keep pace with the needs of rapidly expanding production.

The role which chemistry is playing in wresting priceless war materials from the sea is typical of the production miracles taking place all around us to meet the needs for lighter metals, synthetic rubber and higher octane gasoline. In 1940 when we started work on the plant of the Dow Chemical Co. which was to make magnesium from sea water, the job looked like a big one. But 10 mo. later that plant was in production and within a few months it was turning out four times as much magnesium as the entire country consumed in 1939. The work which we have done since then in planning and erecting additional magnesium facilities for Dow and others licensed by them has given us the pulse of this vast program. Capacities have been doubled and redoubled so that the production of magnesium alone is requiring more power than many a large city uses.

There is more welding in these magnesium plants than has ever been seen in an industrial building, and their water handling volume and tankage runs into gallonages as incredible as our rate of war expenditures.

The speed with which the entire aircraft industry has geared the whole country up for large scale production of fighting planes, pursuit ships, bombers, transports, gliders and the all-important trainers with which our growing army of pilots must earn their wings, has revealed a flexibility of manpower and industrial facilities that will stand America in good stead for all time.

The aviation industry itself has more than trebled its floor space during the past 20 mo., and in 2 yr. our company has designed and built airplane, propeller, aircraft instrument and parts plants with an overall area greater than that of the entire industry's total 2 yr. ago.

But this does not begin to tell the story. The whole concept of production within these plants has changed as conveyorized assembly lines almost a mile long rolled out to accommodate large scale production. Even more significant has been the conversion of tens of millions of square feet in all kinds of metal working shops supplying an ever-growing stream of parts, sub-assemblies and complete equipment to prime contractors, final assembly plants and to the armed forces.

The automotive industry has divided its many talents between aircraft and the limitless production tasks required by engines, tanks and guns to give all our fighting forces the speed, strength and firing power essential to victory. Machine tool builders, equipment manufacturers and many others have all made major contributions.

These giant strides in the size and scope and speed of things on the production front have been accompanied by the dawning of a new day in factory design. With around-the-clock operations, the rule in the majority of war plants, the equivalent of 24 hr. of daylight is being provided generally to insure production efficiency and health. This need is being met by more than 11,000 mi. of glare-free fluorescent lamps which were untried until about 4 yr. ago when we installed them in the world's first controlled conditions (windowless) factory, where light, atmospheric conditions and sound were all under control. Now such plants in all parts of the country are helping the builders of precision instruments, ordnance equipment, fighting planes, bombers, aircraft engines, precision tools and radio equipment meet the rigid specifications which insure performance in battle and production.

Behind the secrecy which necessarily surrounds most war production, we have seen the freest inter-company exchange of information and ideas in business history — jealousies, rivalries and business fueds have been suspended in the interest of all-out production. With each plant bending every effort to speed its work, to save manpower and critical materials, to improve design and quality, sharing what they know in an unprecedented fashion, America's potential capacity for war production knows no limits.

GEORGE A. BRYANT, president of The Austin Co., is well known among the engineering profession for his work in the design and construction of buildings. Mr. Bryant first became associated with The Austin Co. in 1913 as a field engineer near Medicine Hat, Alberta, Canada. In succeeding years he was on the company's pay roll intermittently at various locations in this country and Canada. During World War I he was shop superintendent for the Bristol Brass Co., Bristol, Conn., and for the General Electric Co. plants at Schenectady, being made district superintendent for all Austin operations in New England in 1916. Just before this country entered the war he was placed in charge of the company's new offices in New York and Washington to centralize direction of its operations through the East.

In 1930, shortly after becoming general manager of the company, he negotiated the contracts for the design and erection of the $60,000,000 Russian industrial city, one of the largest projects ever undertaken under a contract embracing all phases of design and construction. Mr. Bryant is actively interested in the development of new structural designs and welded construction and in applying the principles under which working conditions are brought under complete and uniform control in air-conditioned, windowless buildings which have assumed special importance in connection with the desirability of blackout plants for war industries. The material presented on this page was taken from a statement made October 12, by Mr. Bryant

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Women's Styles, Winter 1942-'43

GIRLS! Just look at this lovely ensemble. It is one of several being featured in our best shops this season. Isn't it just too cute for words? Don't you love the smart little apron effect with the clever adjustable shoulder strap over the right shoulder? And the cunning detachable sleeves? They are draped loosely over the shoulders and carry a narrow line of stainless steel sequins down to the wrists. The material is a specially selected tanned cowhide guaranteed not to stain at cocktail parties and washable in Lux. The loose fitting suede gloves add a delicate touch to the ensemble. And, isn't the hat just darling? As pictured it is set to take off in a high wind but it can be tilted down over the eyes so that even your best friends won't know you. The hair covering was designed by Sally Victor, one of the country's leading milliners. It was fashioned especially for Veronica Lake to keep the hair out of her eyes. The bonnet is chic, don't you think, and O, so serviceable. Fireproof, windproof, sparkproof, it is of the most approved riveted construction and makes a swell portable bomb shelter when open. The hose with the funny looking nozzle? Oh, no, that is not a hose at all, it is the lady's pet welding electrode. You see, this is General Electric's new costume for women welders and this young lady is about to do a bit of fine hemstitching on a couple of pieces of armor plate. The General Electric line is one of several lines of complete tailored protective clothing developed for women welding operators in recent months. Cute, hey what?

WITH THE EDITORS

WE ALSO SERVE

Early this year we learned of the construction of a new industrial power plant for a large and noted industrial concern in the middle west. Naturally, we were interested and began negotiations to present an article describing the engineering features of this plant in POWER PLANT ENGINEERING. *These negotiations extended throughout the year. Several calls were made at the plant and we received some encouragement that an article would be forthcoming. Then, two weeks ago we received a letter in which we were informed that "it is the opinion of the management that we must delay this matter until the present wartime emergency has passed. We regret that we will not be able to cooperate with you at this time, but hope that we may be able to do so some time in the future."*

Ordinarily, we would not direct attention to a letter of this kind here since it is the privilege of a company to establish any policy they desire with respect to publicity regarding a plant, but this letter is typical of many that we have been receiving lately. Many companies, because of the war, are establishing more or less blanket rules against publicity of any kind and however sincere their purpose may be in this direction, we do not believe that such rulings are consistent with the best interest of the war effort. It is for this reason that we are presenting here, as an open letter to all American industrial organizations, our reply to the letter referred to above. We do this with the hope of creating a better understanding of the purposes and efforts of the American technical and business press. Our letter follows:

Dear Mr. ———:

We also regret very much the decision of your management not to permit us to present a descriptive article on your new power plant in ———. We knew that you would do a good job on it and it was only natural on our part to want to present a description of it.

Many other organizations throughout the country are taking the same attitude that your organization is taking in this matter, but we had hoped that in your case a more liberal view might prevail.

It is essential, of course, in time of war to guard against the publication of information that might be of value to the enemy and we ourselves try to be most careful in that respect. We, and here I am speaking for the American technical press as a whole, would be the last to want to publish a single sentence that would in any way hamper or jeopardize the war effort.

In all our efforts in the gathering of news, in our dealings with the department heads in Washington, and in our relations with industrial organizations we have all but leaned over backwards to be of help in the war effort. We feel that we have a part to play, in some ways quite as definite as an organization such as yours actually producing war materiel. In some instances it is gratifying to know that our efforts have been of help.

Just to cite an instance, a few weeks ago in a rather round about way, we received an urgent request from the War Department for a list of power stations in Europe. Those who made this request it seems had combed every possible source for this information, including the largest technical libraries here in Chicago, to no avail however. They finally came to us. We had no directory of such stations as they wanted, but from material in our files, in the space of about two hours we were able to furnish them with a list of power stations in Europe from Norway and Sweden to Greece—not only the names and locations, but the capacities, the distribution voltages, etc.

The War Department did not say what they wanted this data for, but we can easily guess and we have a fine letter in our files from the War Department expressing their gratitude for our assistance.

All this, I realize, has nothing to do with the subject under discussion, but I cite it to show that in our own small way we also contribute to the war effort. In Washington the heads of the various departments and the Army and Navy officers have steadily supported and encouraged the technical and business press in its efforts to disseminate information.

Approximately once a month the editors of all the leading business papers gather in Washington to confer with the government department heads.

The people in Washington feel that the technical and business papers are a most effective medium for the transmission of vital information to the businessmen and engineers of the country.

In asking to present a descriptive article on your new power plant, we are not asking you to disclose vital information valuable to the enemy. If you gave us such information we would not publish it. It is of far greater importance to us not to publish such information than it is for you not to give it to us. We do ask you, however, to disclose information that would be of value to others in this country that would help them do a better job.

If your new power plant incorporates features that are of value to you, if it involves equipment and methods that enable you to obtain more efficient production, then these features should be of similar value to other American manufacturers and they should be made available to them. As a rule there are no secret processes in power plants and if there were, we would be glad to keep them secret. There are many things in one power plant, however, details incorporated by the design or methods evolved by the operating staff, that would be of value to designers and operators of other plants, and that is where we come in.

We feel that it is the function of the technical press to spread and disseminate such information and in asking you to cooperate with us in fulfilling this function we do not feel that we are asking any particular favors.

We realize you are busy, that you have plenty to do without spending time writing technical articles or in giving information to technical editors, but we never ask for much in that respect.

Technical editors are trained to gather such information quickly and usually we take very little of an engineer's time in the collection of such data.

If the technical press is of value to American industry in time of peace, it must be doubly so in time of war. It is only by the free interchange of technical and practical knowledge that most efficient use can be made of our resources.

A single idea can result in the saving of thousands of dollars worth of fuel a year in a single plant. If that idea is kept from being applied or used in other plants by arbitrary rulings or ill-advised notions of censorship, it represents a national loss in war or in peace, but a greater loss in time of war.

It is not for us to ask you to reconsider your decision in this matter, but we did want you to know our side. We naturally have our own interests to consider just as you have yours, but our interests, like your own, are not inconsistent with our patriotic impulses or our sincere desire to do a worth while job.

The American technical press has always adhered to high standards of conduct and ethics. Rarely has it violated the confidence imposed in it by American industry in the past and it certainly has no intention of changing its standards in that respect now when the nation is at war.

The publications making up the technical and business papers function under the same censorship rules as the newspapers and wherever there is any question, articles are submitted to the Bureau of Censorship before publication.

Please consider this letter not as a criticism of your ruling but as a means of acquainting you with our side of the situation. You have a perfect right to establish any policy you desire in regard to publicity matters, but today, under stress of war, rulings are often made that would not be made if there was a better understanding of all phases of the questions involved.

Very truly yours,

POWER PLANT ENGINEERING

The Minnkota Power Cooperative, Inc.

The new electric generating station of the Minnkota Power Cooperative near Grand Forks, N. D., is one of the most attractive plants of its kind ever built. Financed by the Rural Electrification Administration, the plant is designed to accommodate six 8-cylinder, 1000-hp. Diesel engines direct connected to 720-kw. generators. Three of these six units have been installed. An original allotment of $860,000 had been made for the plant and transmission system

by Andrew L. Freeman, Manager, Minnkota Power Cooperative, Inc.

"TO ADVANCE THE POSITION OF AGRICULTURE * * * TO ENRICH THE LIFE OF THE COMMUNITY * * * TO FREE MEN AND WOMEN FROM THE HEAVY DRUDGERY OF THE HOME AND FARM * * * THIS GENERATING PLANT WAS ERECTED IN COOPERATION WITH THEIR FEDERAL GOVERNMENT BY FARMERS OF NORTHWESTERN MINNESOTA AND NORTHEASTERN NORTH DAKOTA TO WHOM IT SUPPLIES THE LIMITLESS SERVICES OF ELECTRICITY," so states the bronze plaque located in the spacious lobby of this new and beautiful plant located just north of Grand Forks, N. D. And how true this is for the plant is located in the very heart of the Red River Valley of the North, which is made up of thousands of farms of which less than 1 per cent were afforded the privilege of using electricity prior to the construction of this new generating plant and its associated rural distribution line system.

This beautiful and modern generating plant is an excellently designed and engineered structure which takes its place among the finest of generating plants that can be found in the world today.

In working out the design of this plant, special cognizance was given the tremendous unelectrified area which this plant would eventually be called upon to serve, with the result that its entire construction has been planned and completed so as to represent a neat, compact and practical unit in which the future needs of rural electrification in this area are adequately provided for.

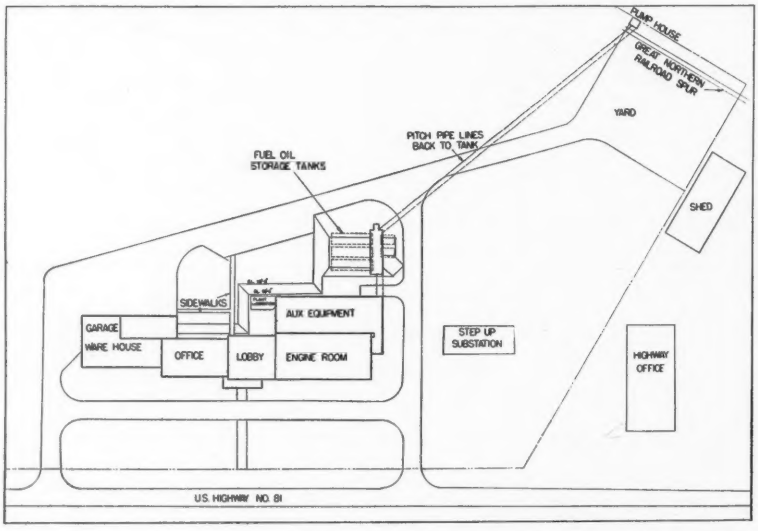


Fig. 1. Plot plan showing the relative location of the engine room with respect to the other buildings comprising the property

The new plant, which has just recently been placed in operation, has been designed to house six 1000-hp, 300 r.p.m. Model LS Cooper-Bessemer engines; three of which have been installed to date and placed in operation. The remaining three engines have been ordered but plans for their installation must necessarily be held in abeyance until such time as the war is over or their installation is required to further our war effort. The engines are direct connected to 720-kw., unity power factor Ideal Electric 2400 v. a.c. generators.

The electrical output of these machines is measured and controlled by means of instruments on an eighteen section metalclad switchboard which was constructed by the Allis-Chalmers Mfg. Co., Milwaukee, Wis. The switchboard measures 21 ft. long, 8 ft. high and is 4 ft. deep. The board is equipped with Allis-Chalmers voltage regulators and automatic synchronizing equipment, Weston indicating instruments, Esterline-Angus recording instruments and Westinghouse watthour meters and switches. The auxiliary equipment panel provides for the control of all auxiliary equipment incidental to the operation of the units as well as an Edwards indicating annunciator system and automatic shutdown arrangement in the event of low or high fuel supply, high water temperature or low oil pressure. Low oil pressure being the only condition capable of automatically shutting the engine down in addition to sounding the alarm. Pilot lights under all

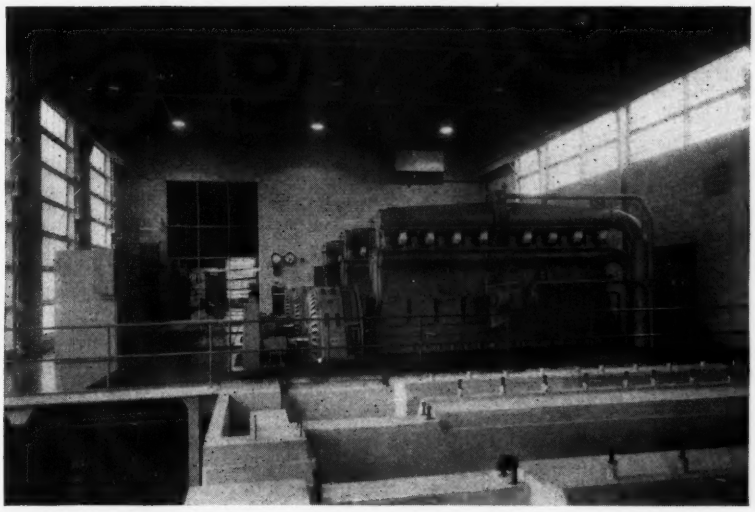


Fig. 2. Three of the six 1000-hp. Diesel electric generating units have been installed, but, as will be noted from this photograph, the foundations for the remaining three units are installed in the present building

switches indicate the operation of all auxiliary equipment when in use. Exhaust temperatures of each cylinder are also read on this panel by means of an Alnor 0-1000 deg. F. 24-point instrument.

The electrical output of the plant is transmitted to seven R.E.A. financed distribution cooperatives at voltages of 34.5 kv. and 12.5 kv. Separate panels in the switchboard provide for the measurement of current in these circuits as well as the remote control of accompanying circuit breakers located in the substation just outside the plant.

A totalizing panel in the switchboard provides for the graphic recording of the total kilowatt demand and bus voltage on Esterline-Angus meters. A Westinghouse watthour meter records the total kilowatt-hour output.

Other panels include a separate exciter and generator panel for each unit installed as well as spare compartments for the three additional units now under construction. A remaining panel is used to house recording instruments and switching equipment on the State Mill and Elevator circuit, with which this plant is interconnected, and which provides one of the interesting sidelights of this installation.

Leading Power Factor

Characteristic of all typical R.E.A. grounded systems is the low leading power factor condition encountered at light loads, the opposite of which is usually found in manufacturing plants employing induction motors where no corrective devices have been installed to correct this condition.

The North Dakota State Mill and Elevator is just such an installation. Many, both large and small, induction motors are used to drive its elevators, mills and various auxiliary equipment and this condition combined with its rather large heating and lighting load creates a lagging power factor. By merely interconnecting these two systems it has been possible to secure sufficient power factor correction to make such a connection highly worthwhile. Other advantages resulting from such an interconnection include standby service in emergencies and also the fact that it gives the mill an opportunity to shut down its power generation equipment completely over week-ends and holidays when the mill is not in

Fig. 3. A view of some of the auxiliaries with the cooling water circulating pumps in the right foreground

operation and thereby effect a substantial saving in the operating costs of its own power plant.

The panel on the switchboard for this interconnection has an Esterline-Angus graphic 800-0-800-kw. reading meter which is for the purpose of instantly telling what exchange of power, if any, is taking place. Two watthour meters record the power transferred to or from the mill and an ammeter shows the current flow in all three phases. Provisions are also made for synchronizing the plant with the mill. A 500,000 cir. mill underground cable and an overhead span of wire are used for the interconnection. In normal operation no real power is transferred unless it is desired by either the mill or the cooperative. However, the normal reactive current flow throughout the day runs from 200 to 300 amp. which does much to improve the plant power factor of both stations.

Foundation Rests on Cork

The generating units are installed on solid concrete foundations measuring 28 ft. long, 10 ft. wide and 9 ft. high. Each foundation consists of approximately 80 cu. yd. of concrete which is insulated from the earth and concrete footings by a layer of cork 2 in. thick. This has been found to be very effective in damping out vibrations from the engine which would normally be transmitted to the rest of the building and surrounding properties.

Each generator is excited by means of a 15-kw. Ideal Electric exciter which is V-belt driven by means of a large pulley on the end of the engine drive shaft. The integral flywheel of the engine and V-belt drives are both enclosed in expanded metal guards.

The air intake for each engine is located on the roof of the auxiliary room portion of the building. The incoming air is passed through American, type 4-OCH, 4-cell filters and is brought to each engine through a 12-in. pipe. The exhaust from each engine is taken from each engine to a point underneath the floors by means of a 16 in. pipe from where it is passed into a Burgess 12-in. special combination waste heat boiler and snubber before being exhausted to the atmosphere. The waste heat boilers are interconnected to a large Kewanee oil-fired burner and are used in heating the entire plant building. The interconnection between the waste heat boilers and the large Kewanee boiler provides for the starting of the large boiler whenever the waste heat boilers are required to furnish more heat than they are capable of delivering. It is estimated that the exhaust of three engines at full load will adequately supply sufficient heat to care for all requirements of the large building in the severest weather.

The lubricating oil for each engine is housed in a 300-gal. sump tank located at the base of each engine, the lubricating oil is passed through a Cuno oil filter and is continuously refined by means of individual Honan-Crane oil filters. The oil is cooled by means of a Ross 1204-CP cooler. At the present time three different brands of lubricating oils are being used. This is being done in an effort to determine the difference in operating costs and suitability of the various oils.

Each engine is equipped with a 600-gal. day fuel tank which is

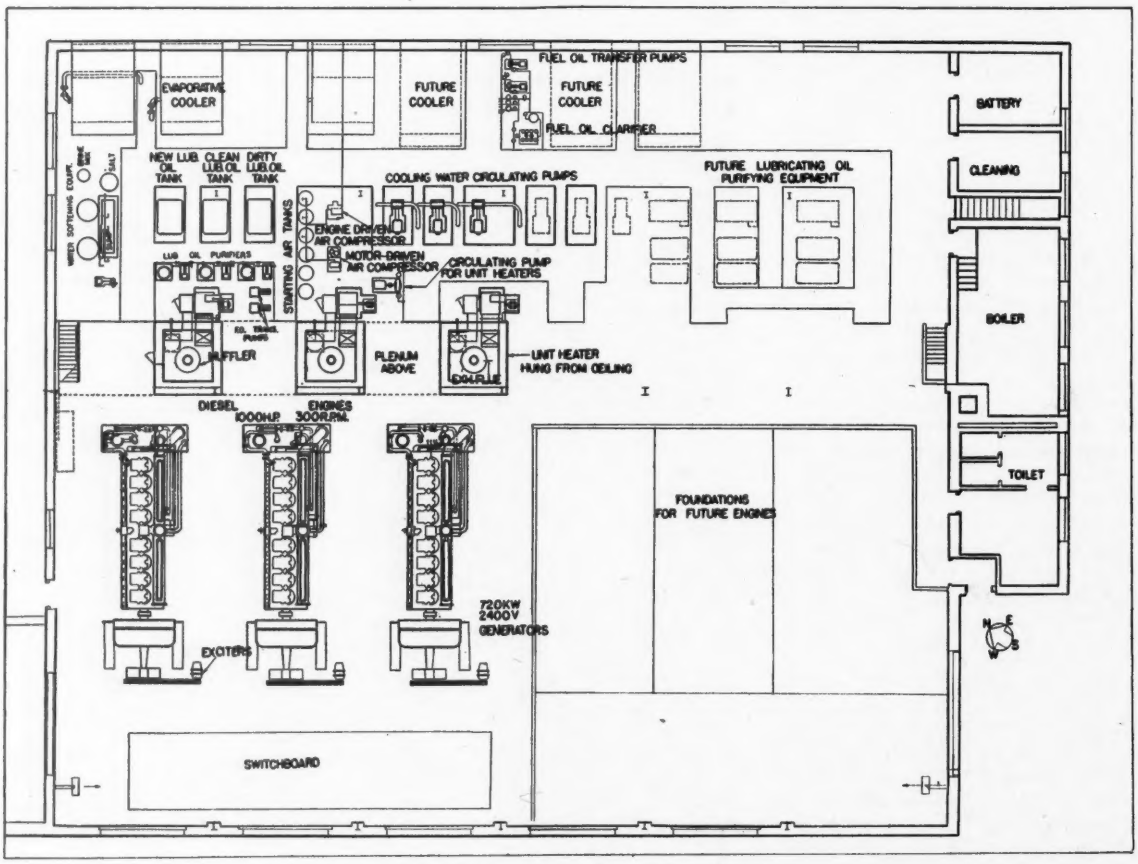


Fig. 4. Plan of engine room and auxiliary equipment

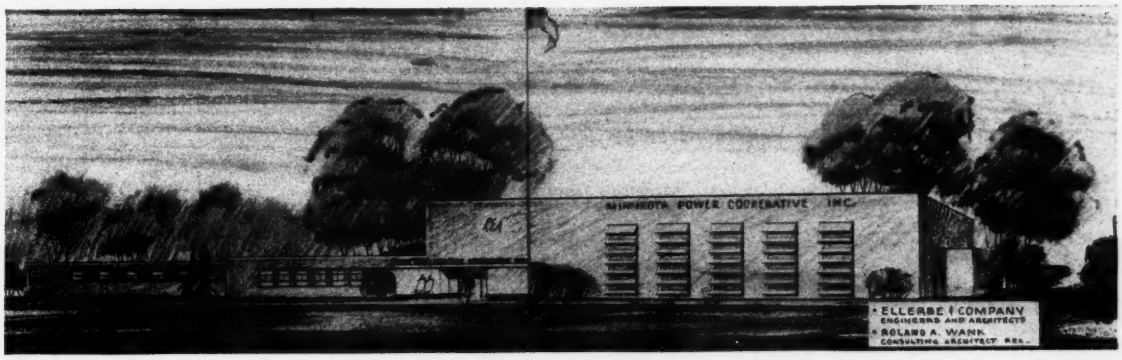


Fig. 5. The architect's drawing of the Minnkota Cooperative plant

located in the basement along side the engine. The tanks are equipped wth Penn high and low fuel alarms which are connected to indicate both on the auxiliary panel of the switchboard and small horns located in the engine and auxiliary equipment rooms. Levelometers are also used to indicate the amount of oil in each tank. Oil from the day tanks is transferred to a small 10-gal. tank located on each engine by means of a small ½-hp. Fairbanks Morse 5-g.p.m. pump. The fuel to each engine is measured individually by means of a 1-in. Pittsburgh meter. Oil storage for the engines consists of 5 underground tanks, all of which are accessible by means of an underground tank house which is joined by a tunnel to the basement of the plant. Three of the tanks have a capacity of 40,000 gal. each, while the other two have capacities of 10,000 and 12,000 gal. each. All of the storage tanks are equipped with Levelometers.

Provisions for receiving incoming oil include both a truck unloading station and tank car unloading racks. All oil received is passed through Pittsburgh fuel strainers and metered before being placed in the storage tanks. Before oil is used in the engine it is again passed through Pittsburgh fuel strainers and a Briggs Model F-3600 clarifier, after which it is returned to a storage tank designated as a clean oil tank. From the clean oil tanks it is transferred directly to the day tanks of the engines by means of a Goulds pump driven by a 1½-hp. General Electric 3-phase motor. To handle heavier oils and also take care of the problem of winter time handling of fuel oil, Sims steam coil heaters have been installed in each storage tank. Provisions have also been made to supply 50-lb. pressure steam to the unloading racks for use in unloading incoming cars of oil. A Sims steam heater is also provided for warming the oil before passing it through the Briggs clarifier.

The cooling system employed is a typical closed system in which each engine is equipped with a Worthington Pump & Machinery Corp. evaporator cooler. The circulating water is pumped by means of Weiman 1-stage pumps driven by 10-hp. Ideal motors. The cooling water arrangement has been designed so that any circulating pump or evaporator cooler can be used with any engine or vice versa. Of special interest is the control arrangement of the damper on each cooler. These are thermostatically controlled by means of motors which have their control equipment located in the cooling water circuit. By means of this arrangement it is possible to control automatically the position of the air damper in the cooler so as to coincide with the temperature of the jacket water. This arrangement is said to be somewhat of an innovation in damper control equipment in that the usual method of damper control employs the temperature of the air drawn through the evaporative cooler instead of the temperature of the cooling water.

Water used in the plant is purchased directly from the water mains of the city of Grand Forks. Before being used, however, it is softened by means of an entirely automatic Permutit water softening system which has a capacity of 9600 gal. every 4 hr., on seven grain hardness water. Soft water is used throughout the entire plant with the exception of the outside spigots and the toilets.

Engine starting equipment in the plant consists of three 20 in. by 60 in. air starting tanks, a Wagner electric motor driven Curtis compressor and a Cooper-Bessemer engine driven compressor as a standby.

Emergency station lighting and operation of the circuit breakers in the switchboard and substation is provided by means of a 60-cell bank of 160 amp-hr. storage batteries which have been furnished by the K. W. Battery Co. The charger is a General Electric automatic model No. 27.1 H.

The station substation is located outside the building and

LIST OF THE PRINCIPAL EQUIPMENT INSTALLED AT THE MINNKOTA POWER COOPERATIVE, INC.

Engines:
The Cooper-Bessemer Corp.
Alternators:
Ideal Electric & Mfg. Co.
Exciters:
Ideal Electric & Mfg. Co.
Governors:
Pickering, Isochronous type
Cooling Water System:
Worthington Pump & Machinery Corp.
Circulating Pumps and Motors:
Weiman 385 g.p.m. pumps
Ideal motors, 10 hp.
Air Filters:
American 12 in. OCH, 4 cell type
Exhaust Waste Heat Boilers and Silencers:
Burgess 12 in., 1000 lb. of steam P.H. at full load
Fuel Oil Transfer Pumps and Motors:
Fairbanks Morse, ½ hp., 5 g.p.m.
Lube Oil Filter:
Cuno
Lube Oil Cooler:
Ross
Lube Oil Filter:
Honan-Crane Corp.
Heating Boiler:
Kewanee
Oil Burner:
National Airoil Burner Co.
Oil Heaters:
Sims
Switchboard:
Allis-Chalmers Mfg. Co.
Emergency Batteries:
K. W. Battery Co.
Fuel Oil:
Cooper Petroleum Co.
Lube Oil:
Deep Rock No. 40—Deep Rock Oil Co.
Vacme B—Socony Vacuum Oil Co.
Non-Pareill—Standard Oil Co.

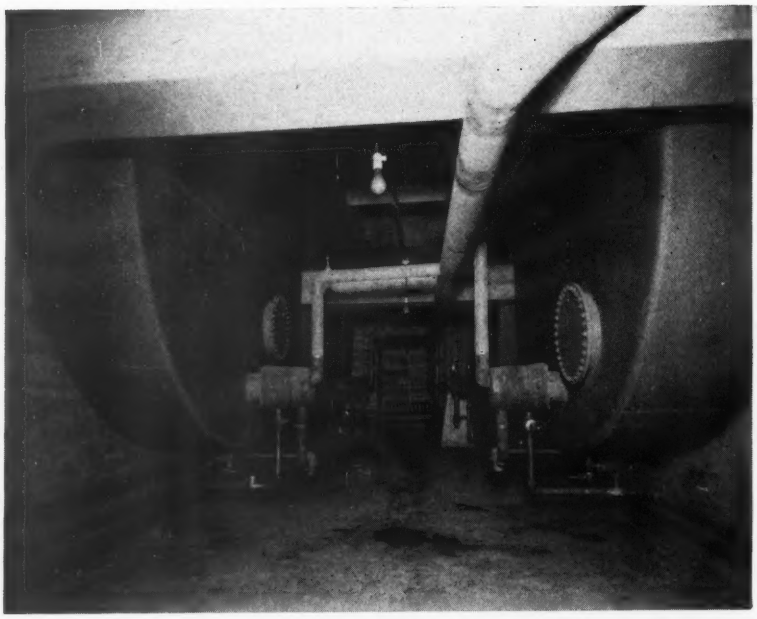


Fig. 6. The underground fuel oil storage tanks

consists of two 75-kv-a. and two 50-kv-a. Moloney transformers. The station panel and station meters are manufactured by Westinghouse as is the lighting cabinet which has 40 branch circuits.

The master substation located near the plant is composed of four 2400/34,500-v., 500-kv-a. Moloney transformers and four 2400/12,-500-v., 333-kv-a. Moloney transformers. The 34,500-v. circuits employ two 600 amp. Delta Star circuit breakers, whereas the two 12,500-v. circuits employ 100-amp. Pacific electric breakers, all of which are controlled from the generating plant switchboard.

The building in which this generating plant is housed has been built to provide facilities for not only the management of the Minnkota but also for one of the distribution cooperatives which it serves. The overall length of the building is 340 ft. which is 80 ft. wide in its widest portion. Provided in the building is a spacious lobby, a large glass enclosed display window surrounding the main entrance, an auditorium, a kitchen and pantry, a large fireproof warehouse, a ten stall car garage, vault, locker room, meter testing room, public toilets and seven work and private offices, all of which go in to make this one of the finest structures of its kind in the world.

The layout, design and engineering work was done by the firm of Ellerbe and Co., St. Paul, Minn. Construction was done by means of force account with C. F. Lewis of Bedford, Ind., as construction superintendent in charge of all construction and installation work. Franklin P. Wood, chief of the generation and transmission section, represented the Rural Electrification Administration which financed the structure.

SELLING KILOWATTS AND KILOVARS

ACTIVE or kilowatt energy, and reactive, or kilovar energy, should be considered as two independent commodities by the power company if maximum economy and usage of materials that go into making up a system is to be obtained. How they can be dealt with as such was discussed recently by J. W. Butler of the General Electric Central Station Engineering Department in a conference paper presented at a Pacific Coast meeting of the A. I. E. E. at Vancouver, B. C.

According to Mr. Butler, capacitors installed by the utility near the consumer afford the best means of supplying the kilovars or reactive energy, with the smallest possible use of existing system facilities. He pointed out that Japan has been doing this for several years to conserve vital materials, and that an installation of 100,000 kv-a. of capacitors has been made at one location in that country.

He also stated that with capacitors, 1 kilovar requires only about 3.5 lb. of material. When reactive energy is furnished by generators in power plants and transmitted through the system, about 330 lb. of material is needed to provide 1 kilovar—almost 100 times as much as with capacitors.

Pointing out that the immediate concern in the war effort is to make available the maximum kilowatt from existing facilities, Mr. Butler said that reactive generators are now being used in many locations.

But it is generally accepted that a majority of the reactive requirements of the country are still being supplied by kilowatt generators, which means valuable system generation, transmission, and substation capacity is being used by reactive requirements that could be used in producing kilowatts.

That there are peacetime as well as wartime advantages, particularly for the power company, in using capacitors to supply kilovars was clearly indicated. If a system is set up and operated on the basis of supplying the bulk of its reactive from the power generators and rates are instituted accordingly in an endeavor to encourage the consumer to generate his own reactive, several interesting angles present themselves.

System kilowatt investment costs are relatively stable, so the cost of delivering reactive by the system as a whole remains substantially constant, but at a high level. With rates established for reactive based on these costs, it would obviously be very profitable for a consumer to buy reactive generators for approximately $10 per kv-a.

Since economic system design and operation is so intimately related to kilovar requirements, it follows that the operating companies would lose control of this important system design factor. It is well known that even today, when load factors are at a maximum, it is the light-load periods that really give voltage and even stability troubles through lack of sufficient reactive control, so what it would mean in this respect if the price of capacitors were greatly reduced in the future can easily be imagined.

From this viewpoint, Mr. Butler concluded that the two requirements of a consumer may best be dealt with by the power company as two indepedent commodities, using separate generators with possibly little common carrier, and even metering them separately.

From notes taken during his work as a boiler inspector, the author has prepared descriptions of several cases of trouble that developed with the use of steam piping. The causes of these difficulties are analyzed and the remedies recommended are described in this article

Typical Troubles with Steam Piping

By C. C. Custer

STEAM piping design, equipment, and operation does not always get the expert attention it deserves. The boiler inspector in looking over many thousands of installations in power plants runs across many cases of improper installations and poor results from improper piping. Sometimes these defects lead to veritable man-traps where an engineer may get into trouble. Accidents often occur that go unreported because the engineer finds himself partly at fault and consequently does not like to tell about it. The engineer should be well posted on these hazards so that he may avoid them. Cylinder heads are knocked out of engines every year by water coming over and the conditions which lead to this sort of trouble should be understood. In taking charge of a power plant, the experienced engineer will want to look over the piping and note if it is properly designed to suit the service and properly equipped with fittings to suit the steam pressure carried.

The defects most commonly found are: Cases of low-pressure fittings in use for pressures above which they are intended. Piping not installed so as to be free of expansion and contraction stresses due to temperature changes or other causes. Piping not pitched properly in the direction of steam flow so they will drain well of the water of condensation. Steam mains not properly drained, water separators not used next to the engine, or faulty steam traps used to drain the mains. We will consider some of these causes of trouble gleaned from an inspector's note book of sample cases of each hazard involved.

Steam pipes should always be pitched so that the condensation in them will tend to flow in the direction in which the steam is moving; the reason for this is that if it is attempted to run condensation against the current of steam, water hammer is quite likely to occur, as the water accumulates into a slug which is finally picked up by the steam and carried along until projected against a fitting. Straightway globe valves should not be used in a steam pipe, as the valve seat acts like a dam in forming a water pocket. Valves of any kind should never be placed so as to form a water pocket whether they be closed or open, if it is possible to locate them any other way.

One frequently sees a stop valve on a boiler placed immediately above the boiler nozzle and a vertical section of pipe above the valve leading to an elbow from which a horizontal pipe leads to a steam main. When a boiler so connected is out of service, water of condensation is liable to accumulate in the vertical pipe over the stop valve, and, although the pipe may be provided with a small drain pipe and valve, experience has shown that this drain is not always used; the engineer may forget to use it. As steam when it has free egress, travels about a mile a minute, a shot of water propelled forward may acquire a lot of momentum.

Pitch of Piping Wrong

On taking charge of an old run-down plant the engineer found out that the steam supply main from the boilers was pitched the wrong way, the pipe being lowest at the boiler farthest from the engine room, thus allowing the liability of a slug of water to lie in this end of the piping. In order to cure this, at least expense, a drain was run from this end of the pipe to a steam trap thus to keep the line clear from condensation.

This would have been all right, but the engineer failed to take into consideration the fact that steam traps are not 100 per cent reliable, they sometimes fail to function. One evening when getting ready to start up the electric light plant, the engineer failed to check the trap to see if it was operating before he got up on top of the boiler to cut it in and, as he was opening the stop valve, a terrific water hammer started in the mains. The first blow being light, with increasing violence and on the third

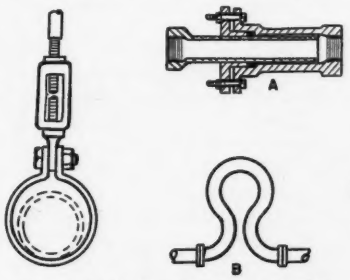


Fig. 1. (Left) Pipe hanger of flexible type. B. Expansion loop.

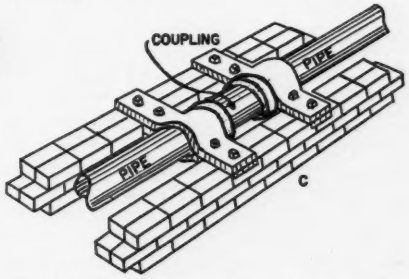


Fig. 2. A. Common type expansion joint. C. Pipe anchor

blow the blank flange on the rear end of the piping was blown off and through the side of the building, landing on the side of the hill about 300 ft. away. We are unable to account for water hammer increasing in three strokes, unless it be that the first one caused a baring of the comparatively cold part of the pipe, then a rapid condensation on the cold part causing a resurgence till about the third stroke the water acquired enough momentum to bust something.

The writer was eye-witness to another occurrence similar to the above where the mains sloped in the direction of flow and this time it took off the blank flange on the end of the steam pipe in the engine room. In this case four boilers discharged their steam into the engine room and the occupants of the room found it hard to grope their way out of the room till the steam cleared up.

When a water-hammer occurs as one is attempting to start an engine, it often results in a cylinder head being blown off or the engine being wrecked in some other way. Before starting an engine, it is well for the engineer to check the water in his boilers, see that his steam mains are well drained and traps functioning and the engine itself well warmed up and free of condensation before bringing it up to speed. We recently went to see a wrecked engine where the cause was something like this:

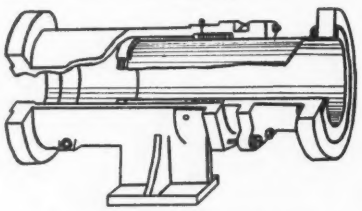


Fig. 3. Anchor type expansion joint

They had two batteries of boilers, the older battery of which had its steam main on a lower level than the principal distributing main which was of course a mistake. In order to keep that end of the main free they had installed a drain ending in a tilting trap; which functioned all right for a long period, but one day the trap failed to tilt and a shot of water came over and wrecked a large Corliss engine. Steam traps should have water glasses on the side so that you can see a water level in it. In our opinion none of them can be trusted 100 per cent.

An unfortunate engineer who took charge of a little plant in a small town encountered a circumstance not covered by his previous experience. His boiler feed pump got its supply from the city water mains whose normal pressure was ordinarily about 40 lb. In cases of a fire breaking out, however, the pressure was often boosted to about 100 lb. One day this happened when the engineer was carrying only about 80 lb. Consequently although the pump was presumably not in operation the excess water pressure fed right through the pump and filled the boiler before the engineer knew it and came over in the steam line and wrecked his engine.

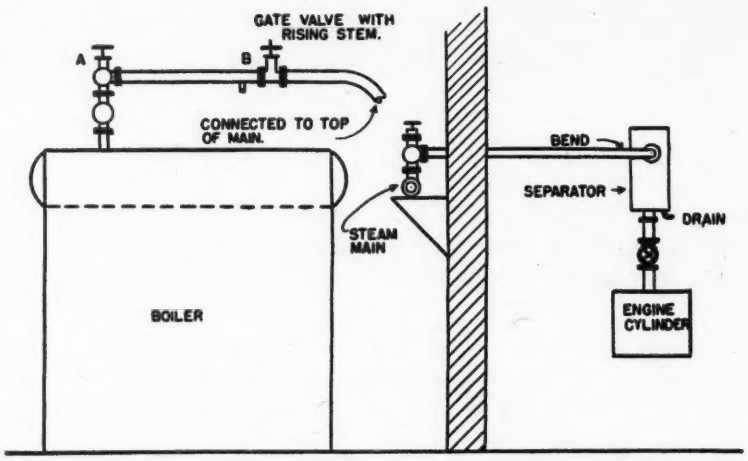


Fig. 4. Back-to-back arrangement of piping between boiler and engine

Line Used Intermittently

An interesting case was an auxiliary steam line run from an electric light plant to a waterworks plant next door. The waterworks was ordinarily run by water power excepting at times of scarcity when they would ask to have the steam turned on until the hydraulic head was augmented so as to go back to water power. This steam line being first hot and then cold was continually springing leaks at threads and packed flanges. We suggested that it would be a better arrangement to leave the steam in the line all the time and have the flanges as well as piping well covered with asbestos and have a trap on the end of line to keep it well drained of condensate under which condition the line when once made tight would stay tight. It is a hard service when piping is subject to extreme changes of fluctuating temperatures. It seems the wrought pipe does not expand and contract at the same ratio as does the cast-iron fittings; thus there is always a tendency to spring a leak.

A common cause of trouble in laying out steam lines is the neglect of the engineer to make allowance for expansion and contraction. Wrought iron expands about 0.00008 in. per lineal foot per degree F. rise in temperature. This might seem to the novice to be a negligible fraction; its presence, however, in the equation often means the difference between success and failure. Note the following: The boiler operating a hoisting engine on a dock failed completely and it was planned to run a 2-in. pipe from an electric plant about 1000 ft. away to supply the hoist temporarily. A 2-in. line was run down from the top of the boiler. It had two square turns in it and passed under a cement walk and was cemented in. It then made a straight run of 1000 ft. along a railroad trestle, being fixed to the under side of the trestle with ordinary pipe cleats. On looking over this job we expressed the opinion that the arrangement would not work because no provision had been made for contraction and expansion.

Looking in the steam tables, we find the temperature of steam at 150 lb. would be roughly 365 deg. and with an atmospheric temperature of 65 deg. this would be a rise of temperature of about 300 deg. Thus the expansion of the 1000 ft. length of pipe would be $0.00008 \times 300 \times 1000 = 24$ in. The mechanic who did the work wanted to try it out anyway. When he turned on the steam the pipe began to crawl like a snake; it tore off many of the pipe straps and finally broke at both elbows where the square turns were. This job was made temporarily workable by running the pipe on the surface of the ground, anchoring

it at three places and putting in three swing joints midway between the anchors.

A similar case from our notebook was the case of a 2-in. steam line attached to the side wall of a heating tunnel serving a group of buildings of an educational institution. This line was used during certain hours for cooking by steam in the kitchen of the institution. The line ran about 200 ft. north, then about 300 ft. east, then north a short distance, where it made a short turn and entered the kitchen. In the tunnel, this pipe was supported on a pipe rack but it showed a tendency to break its straps and crawl off the rack when the steam was turned on, and it broke three different times at the last turn before entering the kitchen. On examination it was found that the reason for the breaking was that the end at the tunnel was anchored fast. This anchor was removed and the pipe was allowed to expand freely back into the tunnel. This line was put in good working condition by anchoring it in the middle of the long runs and suspending it from the ceiling of the tunnel by flexible hangers of a type like Fig. 1 throughout its length and letting it expand where it turned the corners. Thus the job required no expansion joints. Expansion joints are more or less a nuisance as they require packing periodically. They, however, are essential to solve certain problems of expansion.

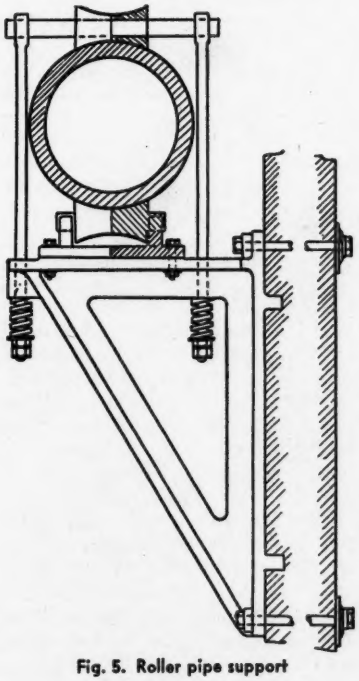


Fig. 5. Roller pipe support

In laying out mains for steam heating in cities it is necessary to design carefully both anchors and expansion joints. Figure 2-A shows a type of expansion joint. Some people prefer to use an expansion U-bend which is housed in a box under the street. In Fig. 2-C is also shown one way to anchor the pipe which is generally done in the middle of the square. It is necessary to have both expansion joints and anchors, although sometimes an expansion joint is used that also serves as an anchor. Note the leg on expansion joint (Fig. 3) by which it can be anchored into masonry. The joint shown in Fig. 2-A has no anchor to hold it in place; if two of these that have no anchor between them are adjacent there is the hazard of the intermediate piping shifting all in one direction and you are liable to go back sometime and find the one joint entirely closed and the other entirely open or come apart. We know of a case where a joint in a heating main thus opened up and let steam into a newly finished office building and spoiled all the paint.

Piping difficulty was encountered in a heating plant built separately to heat a number of school buildings. The main steam pipe (6 in.) ran in a straight line about 300 ft. to the first building, starting from next to a wall and ending up against a wall where it made a square turn. It was in cramped quarters and when the steam was turned on the pipe expanded and began to push the wall down.

In respect to the logical arrangement of boiler and engine rooms, there are two common arrangements in vogue: (A) that in which the engines and boilers are placed back to back with a dividing wall between them, and (B) that with the boiler and engine rooms end to end with the boilers and engines lying in the same direction. As far as piping is concerned, the back to back type is the one most to be preferred on account of the short and direct connection between the engines and boilers and the ease with which the plant can be enlarged. Connections must not, however, be too short and rigid and one way to get flexibility is to use pipe bends in the line from boiler to steam main and from steam main to each individual engine. It is planned thus to have stresses of expansion and contraction relieved in these bends. This arrangement is shown in Fig. 4. The steam main runs at right angles along the wall and its expansion is taken care of by mounting it on rollers supported on wall brackets as shown in Fig. 5.

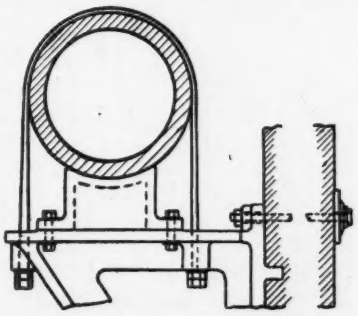


Fig. 6. Anchor for steam main

The type B layout generally requires the piping from boiler room to come through the wall into the engine room and drop into the main header which runs at right angles. Often it is desirable to anchor the line from boilers at or near the wall by some such anchor as is shown in Fig. 6. This is perfectly feasible provided the runouts from the boiler to the main are made flexible enough to care for the expansion there.

Note that the latest A.S.M.E. Boiler Code requires that where two or more boilers are connected to a common header, there shall be installed two valves in the run-out from each boiler to the main, the one nearest the boiler may be an angle valve or gate valve, or preferably a non-return valve and the one nearest the main header to be a rising stem gate valve. The intermediate pipe between these valves shall have an ample free-blow drain between with the discharge of the drain in plain sight of the operator when cutting in the boiler. This is to detect a condition where a slug of water might be lying in the main. The outside screw-and-yoke type of gate valve finds favor with most designers because it can be seen from a distance whether valve is closed or open.

In our experience where steam mains give considerable trouble springing leaks at threads and flange packings it is often caused by excessive stresses from expansion and contraction forces. We were once troubled by a flange joint above a boiler springing a leak and on taking the joint apart we found that the boiler setting had settled so as to throw a strain on this joint and it was almost impossible to get the joint back together again.

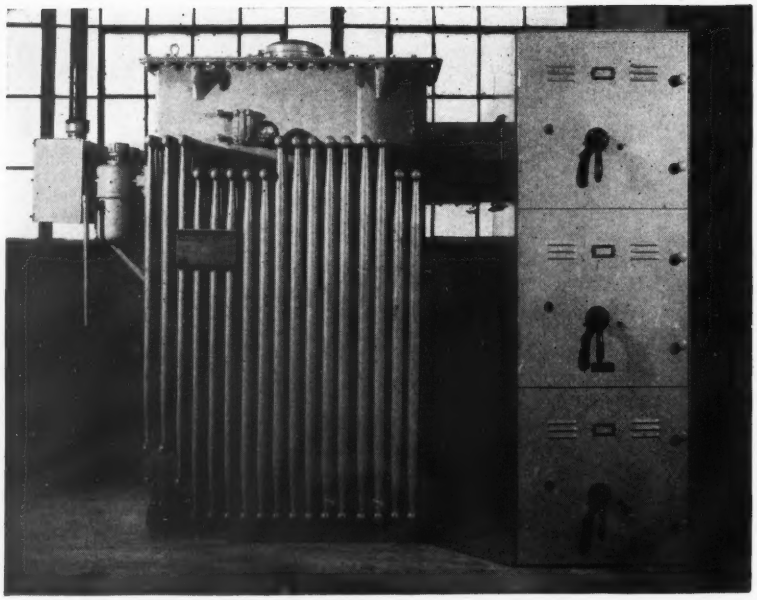


Fig. 1. Typical installation of load-center unit substation in working area of a war factory

Save Copper in War Plant Power Distribution Systems

By D. L. Beeman and W. J. McLachlan

General Electric Co., Schenectady, N. Y.

Copper is a strategic material; it is highly essential in the manufacture of armament. Copper is also a material of vital importance in the electrical industry, but there are opportunities for saving copper in the electrical industry which if taken advantage of will permit more copper to go into ordnance. In this article the authors show in detail how much of the copper that ordinarily goes into electric distribution systems can be saved by proper design of such systems. By the use of high voltages, practicable in industrial plants, as much as 98 per cent of the distribution copper can be saved

EVERY POUND of copper wasted in an electrical distribution system is 1 lb. of copper which cannot go into ordnance materiel to win this war. It is the patriotic duty of the electrical engineering profession to do its utmost to conserve this vital material.

The opportunities for savings are many and large. The great number of new war plants and additions to existing installations are each requiring from a few to hundreds of tons of copper for their electrical distribution systems. Differences in copper requirements of more than 100 tons in an individual plant have resulted from variations in the distribution system layout without appreciably changing the efficacy of the system.

Designing systems with the primary objective of reducing the copper content is a new approach to many in the industry. Study of hundreds of plant layouts indicates that the major savings will be effected if certain simple fundamentals are followed, which are hereafter set forth to assist in the undeniably worthy objective of conserving every pound of copper possible.

1. *Cover as much distance with high voltage and as little with low voltage as possible.* The amount of copper required to transmit 1000 kv-a. at various voltages is given in Fig. 2. In many cases which have come to the authors' attention, voltages below 600 v. have been used to transmit large blocks of power for several hundred feet where voltages of 4160 or even 13,200 v. would have been thoroughly practical. Using the higher voltage will save as much as 98 per cent of the copper in the cables.

2. *Locate the substations at the center of the load area.* In systems with the substations located outside the working area, 50 per cent to 75 per cent of the total copper required is for low-voltage feeders. Merely moving the substation to the center of the load area reduces the low-voltage feeder length by an average of 33 per cent (Fig. 3). This reduces the total copper requirement by about 10 to 40 per cent.

3. *Use small size substations.* By using, for example, four small substations rather than one large

substation to serve a square load area, one-half of the low-voltage feeder copper can be saved, Fig. 4. Substation ratings higher than 1000 to 1500 kv-a. with 480-v. or 500 to 750 kv-a. with 208/120-v. secondaries usually indicate an opportunity to conserve copper by dividing the substation into smaller units. There is, however, a limit to the desirable reduction in ratings, for, as the size is reduced more material is required for high-voltage feeders, and less efficient use is made of the material for constructing smaller substations. In general, the optimum rating of a substation with 480-v. secondaries will be from 500 to 1000 kv-a.; for 208/120-v. or 240-v. secondaries the optimum rating is 300 to 500 kv-a., 3-phase.

Saves Many Tons of Copper

That many tons of copper can be saved by the application of the above principles is illustrated in Fig. 5. The left-hand diagram is an old style distribution system as applied to a factory, whereas the right-hand diagram is a new or load-center system which is fully equivalent. The old method requires 65,000 lb. of copper, whereas the new requires only 27,200 lb., thus *saving* 37,800 lb. Of special interest is the fact that the savings themselves represent more copper than is required for the entire load-center distribution system, including all of the substation apparatus.

In this comparison a large margin has been allowed for diversity in the load-center distribution by using four 1000 kv-a. unit substations for general power and lighting, whereas only 3000 kv-a. of transformer capacity was provided in the old style arrangement. With this large margin for diversity, the steel content of the two systems is essentially equal. In the average cases less diversity would have been allowed for, in which case there would have been an even greater saving in copper and a substantial saving in steel as well.

To obtain the benefits of load-center distribution as outlined above requires that the substations be located at the center of the load area and this often may mean right in the working area. Compact, enclosed substation equipments, utilizing non-inflammable liquid for transformer cooling and insulation, can now be installed in working areas without requiring vaults. These units can usually be located on sub-balconies, adjacent to or over washrooms, along building column centers and in similar areas of minimum value as working space. In any event, they occupy an area of only 1/10 to ½ of 1 per cent of the total floor space of the plant. Figure 1 shows a typical load-center unit substation installation.

Other copper saving principles are:

4. *Distribute power at the highest practical voltage.* By selecting the highest practical primary (2.4 kv. to 15 kv.) and secondary (600 v. and below) voltages, a large percentage of the copper required for feeder cables can be saved. For example, to carry 150 kv-a., 3-phase at 208 v. requires three 500 MCM conductors weighing 4.6 lb. per ft., and at 240 v. three 400 MCM conductors weighing 3.78 lb. per ft., whereas at 480 v. three 2/0 conductors, which weigh only 1.2 lb. per ft. will do.

Similarly 500 MCM cable is necessary to carry the same kv-a. at 2400 as a 4/0 will carry at 4160 v., or as a No. 5 will carry at 13,200 v.

5. *Use cable with high temperature insulation.* On the basis of the 1940 National Electrical Code an 85 C varnished cambric insulated 250 MCM cable will carry as much current as a 500 MCM cable insulated with 50 C code rubber. However, an interim amendment to the 1940 code, which will be effective only for the duration of the war, allows code-rubber insulated cables to be applied on the basis of the higher current carrying ratings of the 1937 code. On this revised basis a 300 MCM code rubber cable will carry as much as the 250 MCM varnished cambric cable. In either case the copper savings may be substantial.

6. *Use simple electrical distribution systems.* In general, it is axiomatic that the more complicated the distribution system the more copper that is required to carry a given kv-a. load. It is often said that extra complication is necessary to give satisfactory service reliability. There is actually so little difference in the service reliability of the simplest plant systems (straight radial) and the most complicated (secondary network) that it is questionable, in these

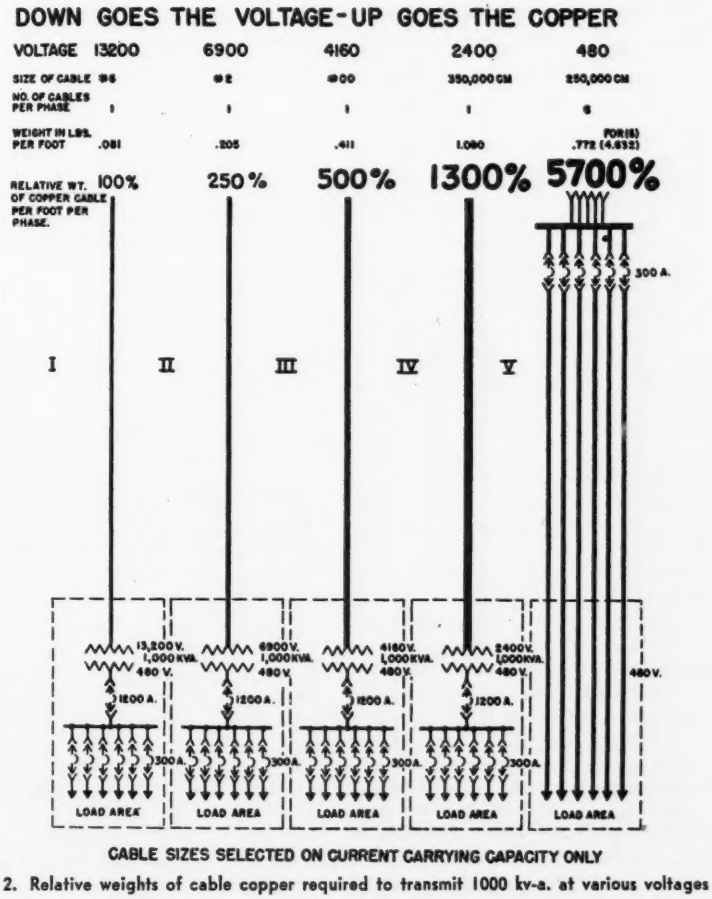

DOWN GOES THE VOLTAGE-UP GOES THE COPPER
VOLTAGE 13200 6900 4160 2400 480
SIZE OF CABLE #6 #2 #00 350,000 CM 250,000 CM
NO. OF CABLES PER PHASE 1 1 1 1 6
WEIGHT IN LBS. PER FOOT .081 .205 .411 1.080 FOR(6) .772 (4.632)
RELATIVE WT. OF COPPER CABLE PER FOOT PER PHASE. 100% 250% 500% 1300% 5700%
300 A.
I II III IV V
13,200 V. 1,000 KVA. 480 V.
6900 V. 1,000 KVA. 480 V.
4160 V. 1,000 KVA. 480 V.
2400 V. 1,000 KVA. 480 V.
480 V.
1200 A.
300 A.
LOAD AREA
CABLE SIZES SELECTED ON CURRENT CARRYING CAPACITY ONLY

Fig. 2. Relative weights of cable copper required to transmit 1000 kv-a. at various voltages

times of material scarcities, if as much as 40 to 50 per cent more copper should be added to a straight radial system for the very slight improvement in service reliability that may be obtained. This is true particularly in view of the fact that the great majority of plants have used the simplest type of radial system and with excellent results.

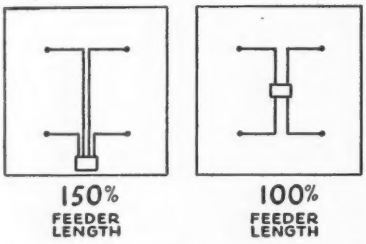


Fig. 3. Relative low-voltage feeder lengths for a substation located at the side of, and in the center of the load area

In Fig. 7 are one-line diagrams of a simple radial and a secondary network system of distribution for a specific factory. The copper required for the substations and tie cables of the secondary network is 51,600 lb. as contrasted to 28,500 lb. for the substations of the radial system. The steel requirements in either case are about a standoff. The large copper savings, 23,100 lb., result principally from eliminating the network tie circuits which are not required in the radial system. More copper can thus be saved than is required for all of the transformers of the radial system.

Large Transformers in Radial System

In this comparison, more larger size transformers have been used in the radial than in the network system to allow for diversity. However, the opposite is generally true, i.e., less transformer capacity is needed in the radial systems, in that, the loss in diversity is more than offset by the necessary reserve capacity in the network.

7. *Select the proper equipment.*

(a) *Switchgear*

Factory-assembled metal-enclosed switchgear equipment requires in general, substantially less copper than other types of installations, due to (1) the low bus height permissible with the metal-enclosure and hence short lengths of connecting copper required per breaker position, (2) the close center to center spacings permissible with removable breakers which result in much shorter bus lengths, and (3) the elimination of separate disconnecting switches with their large copper content. In Fig. 6 is shown the one-line diagram for a typical station fabricated from separate supply devices and in contrast one employing modern factory-assembled unit substation construction. The switching station of the former requires 7900 lb. of copper and the switchgear of the latter 2800 lb., thus saving 5100 lb. or about 65 per cent.

Wood Structure Design

Even though the piecemeal outdoor substation was designed with a wood structure, the remaining amount of steel required for the outdoor breakers and other parts is slightly greater than the total steel required for the outdoor factory-assembled equipment complete. Had it been designed with a steel framework, it would have required considerably more steel.

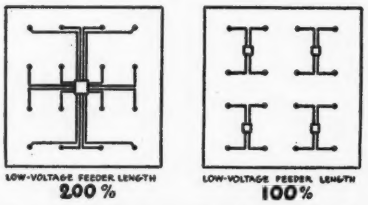


Fig. 4. Relative low-voltage feeder lengths required for one large substation and for four small substations serving a given load area

(b) *Transformers*

The use of auxiliary cooling equipment in the form of forced-air on medium size banks and forced-oil in combination with forced-air or water cooling on large transformers, results in substantial material savings. As an example, the copper required for a 30,000-kv-a., 138-kv., 3-phase transformer is reduced 23 per cent and the steel 28 per cent by the use of forced-oil circulation in combination with forced-air coolers.

A second expedient which saves material, except in the smaller distribution transformers, is the use of 3-phase instead of three single-phase transformers for supplying 3-phase loads.

The copper savings as mentioned above for both transformers and switchgear are obtained when modern unit substations are applied.

This concludes the fundamentals to be listed, although other opportunities for saving copper of lesser amounts will be discovered when individual systems are laid out with the prime objective in mind of saving copper.

Copper Waste

While not a basic factor in the actual layout of the system, one of the greatest wastes of copper results from over-estimating the anticipated loads in new plants. Many layouts have been based throughout on total connected loads, whereas actual loadings have been found to be less than half of these values due to diversity. As the final point in this article let us conclude by emphasizing the first important step to be taken in saving copper in a plant distribution system:

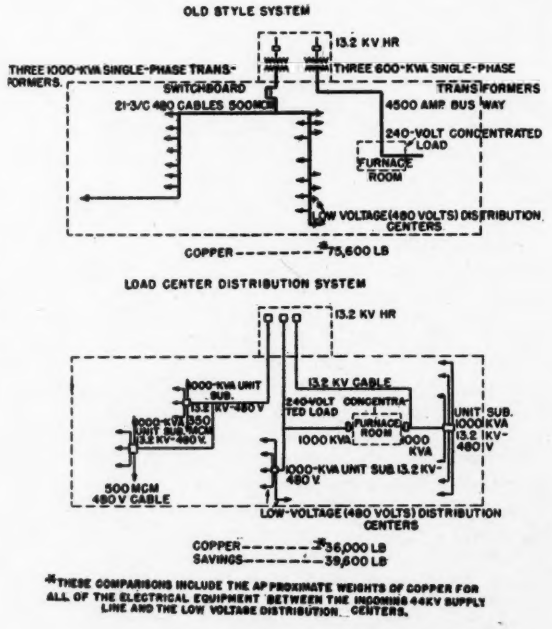


Fig. 5. Circuit diagrams of a typical factory with old and new arrangements. The new or load-center arrangement employs principles 1, 2, and 3, whereas the old does not

*THESE COMPARISONS INCLUDE THE APPROXIMATE WEIGHTS OF COPPER FOR ALL OF THE ELECTRICAL EQUIPMENT BETWEEN THE INCOMING 44KV SUPPLY LINE AND THE LOW VOLTAGE DISTRIBUTION CENTERS.

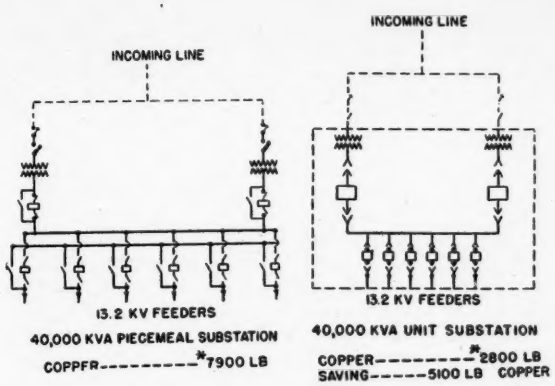

INCOMING LINE
INCOMING LINE
13.2 KV FEEDERS
40,000 KVA PIECEMEAL SUBSTATION
COPPER---------*7900 LB
13.2 KV FEEDERS
40,000 KVA UNIT SUBSTATION
COPPER---------*2800 LB
SAVING------5100 LB COPPER
*WEIGHTS OF MATERIALS ARE BASED ON 13.2 KV SWITCHING EQUIPMENT ALONE SINCE TRANSFORMERS AND HIGH VOLTAGE SWITCHING STRUCTURE WOULD BE PRACTICALLY IDENTICAL IN EITHER CASE

Fig. 6. (Above) Typical circuit arrangement for piecemeal open type substation fabricated from separate supply devices and a unit type substation with metal-enclosed, factory-assembled low-voltage (15 kv.) switchgear

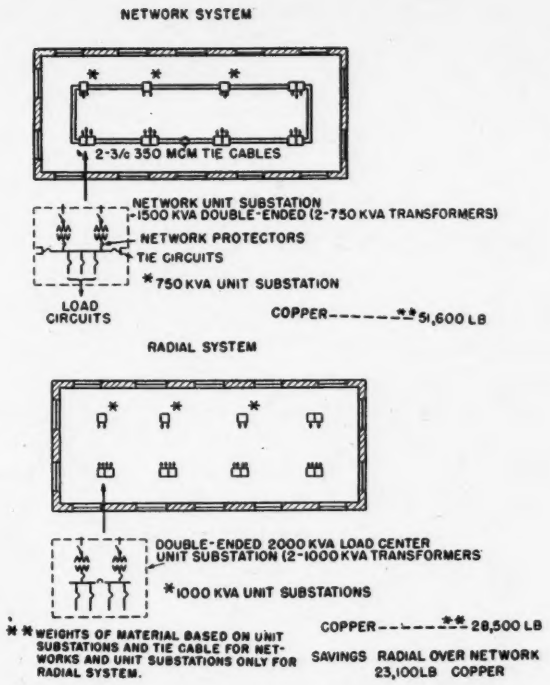

NETWORK SYSTEM
2-3/c 350 MCM TIE CABLES
NETWORK UNIT SUBSTATION
1500 KVA DOUBLE-ENDED (2-750 KVA TRANSFORMERS)
NETWORK PROTECTORS
TIE CIRCUITS
*750 KVA UNIT SUBSTATION
LOAD CIRCUITS
COPPER-------**51,600 LB
RADIAL SYSTEM
DOUBLE-ENDED 2000 KVA LOAD CENTER UNIT SUBSTATION (2-1000 KVA TRANSFORMERS
*1000 KVA UNIT SUBSTATIONS
COPPER-------**28,500 LB
**WEIGHTS OF MATERIAL BASED ON UNIT SUBSTATIONS AND TIE CABLE FOR NETWORKS AND UNIT SUBSTATIONS ONLY FOR RADIAL SYSTEM.
SAVINGS RADIAL OVER NETWORK 23,100LB COPPER

Fig. 7. (Right) Typical wiring diagram of a network and a straight radial distribution system for a specific factory

Base anticipated loadings on the best available loading data for similar plants. It is a rare plant indeed whose circuit loadings equal the totals of the connected apparatus ratings. *Over-estimating loads and overbuilding systems ties up copper which should be put to work in the more direct tasks of winning this war.*

Wood Piping Installation

By ROBERT TURNER

IN A TYPICAL 35,000-man cantonment a water system of wood pipe would save 9,193,600 lb. of iron and $222,140. Nine million pounds of iron would make quite a few tanks.

These figures are from a report by Beasley & Stoehr, hydraulic engineers of Portland, Ore., who made a study for the relative merits of wood stave pipe versus cast iron, basing their analysis on 1941 prices of Class 150 bell and spigot cast iron pipe with caulking materials and untreated, machine banded wood pipe, banded for 250 ft. head with galvanized wire and fitted with creosoted collars.

The total cost of a water system for such a camp would be $194,740 for wood pipe as compared to $416,880 for cast iron, and the amount of metal involved would be 1,184,700 lb. against 10,378,300. Wood pipe weighs 60 to 71 per cent less than metal.

Use of wood pipe in military establishments is not new. It was used by the A. E. F. during World War I with excellent results. One of its greatest assets was its lightness, as it had to be shipped from this country to France and distributed there.

Wood pipe can be used advantageously for drainage, water supply or sewage. It costs less than one-half as much to install and it can be laid by common labor, whereas skilled or semi-skilled labor is required to lay cast iron pipe.

Wood pipe is made in two general types: machine banded and continuous stave.

Machine banded wood pipe is manufactured in random lengths up to 20 ft., 2 to 24 in. inside diameter, spirally wrapped with heavy, galvanized steel wire. Each joint, complete with coupling, is a finished piece of pipe ready for installation.

After thorough seasoning, the lumber is milled to the pipe stave pattern, the inside and outside faces milled to the concentric circles of the pipe, and the edges to the true radial lines with a small groove on one edge and a corresponding tongue on the opposite edge.

The staves are assembled and clamped into position, then spirally wrapped with heavy, galvanized steel wire. Where chemical conditions demand the pipe can be banded with other metal or alloys.

Finally, the outside is usually heavily coated with hot coal tar and pitch to protect the wire, then rolled in fine sawdust. Any type of coating or fabric covering can be supplied.

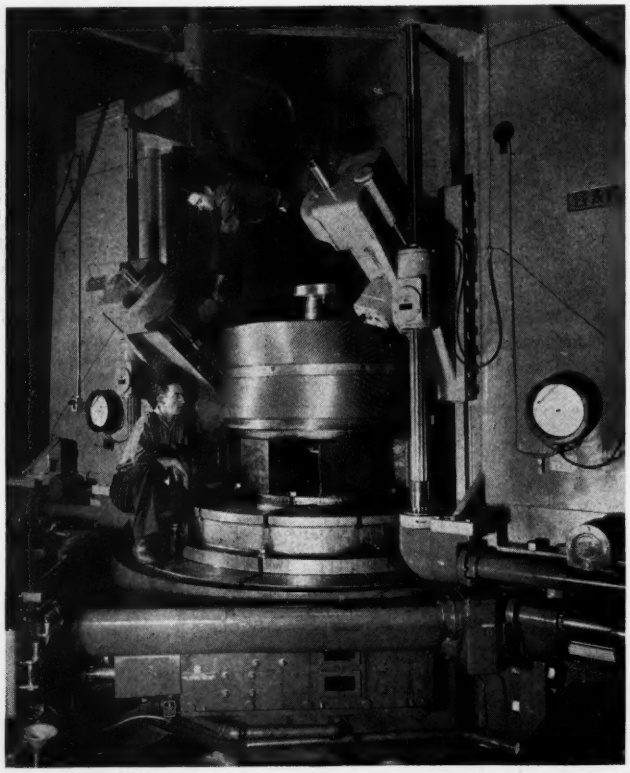
Each joint of pipe is fitted with its necessary couplings at the factory. All that is necessary on the job is to drive the joints together. Swelling of the wood makes the connection tight, thus eliminating the use of bolts, gaskets, or packing.

Continuous stave wood pipe is made from 6 in. to 20 ft. inside diameter and is used principally in sizes larger than 24 in. The joints connecting the staves end to end are made either with galvanized steel tongues or malleable iron butt joints.

Wood pipe has long been used and is being specified today for municipal water supply systems, power plants, and irrigation projects. Under normal conditions, wood pipe will give excellent service for 30 to 50 yr. without appreciable maintenance cost.

PICTURES

(Left) Machinery designed to handle a 75-man double deck elevator and a skip hoist with two 12-ton skips operated in balance has been installed in this modern machine room at the Negaunee Mine Co.'s new Mather Mine. The massive concrete footings designed to accommodate all heavy machinery are completely isolated from the rest of the structure. Equipment for operating the man hoist is in the foreground, with that for the skip hoist to the right

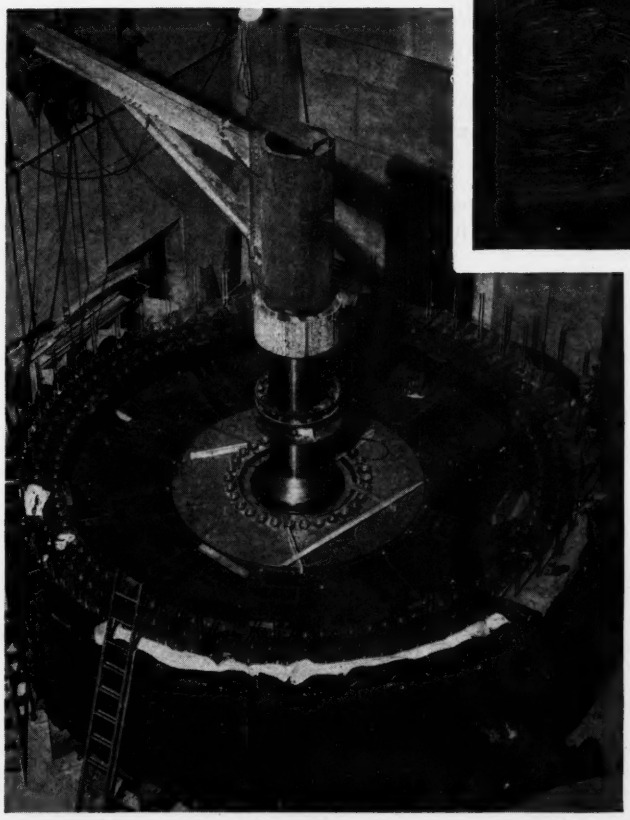


(Right) A view showing the operation of cutting steel teeth. Marine reduction gears are cut with great precision in an air conditioned room at the Steam Division of the Westinghouse Elec. & Mfg. Co. Once the tooth-cutting operation is started, it must continue without stopping for about 7 days at constant temperature to insure the utmost accuracy. The slightest discrepancy causes a deafening screeching and squealing when these gears turn at high speeds

(Left) The problem of skilled labor is one that continues to be one of the most vital in the nation's war effort. It takes skill of a high order to turn out work such as is shown in the photograph. It is a view taken in the shops of the Baldwin Locomotive Works. Working to tolerances of a thousandth of an inch or less is always difficult, but when working to such tolerances with large masses such as the piece shown in this lathe the difficulty increases due to the effect of resulting expansion and contraction

# of Engineering Interest

(Right) A worker in the Salvage Division of the Union Electric Co. sorts and coils used wire according to size, length, hardness, and condition of its insulation. This is the first step in getting salvaged copper wire ready for reprocessing. The reprocessing machine used in this salvage process was made up of scrap material. The machine resaturates and rewaxes the used wire, and after a coat of tar is put on, the wire is put back into service. Previous to the installation of this reprocessing machine only the wire with protective wax was returned to use, and the rest was sold as scrap. Now, all the wire over 15 ft. long is welded and reprocessed



(Left) The first of the 450-ton rotors for the two 75,000-kw. Shasta Dam generators, being temporarily installed in the mammoth Grand Coulee Dam power plant to prevent a power shortage in the Pacific Northwest, has been practically completed. The big wheel is about 25 ft. in diameter and 7 ft. high. Both machines are scheduled to be in operation before the end of the year

(Right) High in the sky these daring workmen are helping to weave a network of high-voltage lines to take Grand Coulee Dam power to war industries in many parts of the Pacific Northwest. Production in the big power plant is being increased at a record-breaking rate, making it necessary that erection of new power lines be rushed. Three 108,000-kw. machines are in operation and two 75,000-kw. units (one is shown to the left above) temporarily transferred from Shasta Dam in California, will see service before 1943. Three other main units are expected to be added during next year

Making a Phosphate Control System Work

To be effective, phosphate control must be as reliable as a watch and as accurate. Erratic performance may be caused by several factors as explained in this article reporting an investigation undertaken to correct operating difficulties. Detailed methods of checking the equipment, of getting reliable samples and of reporting the results are included. Typical charts show the "before and after" results

by J. W. ODLUM, General Foods Corporation, Post Products Div., Battle Creek, Mich.

BECAUSE of its importance, the question of boiler water treatment was given a great deal of attention when the new plant was built.[1] Based on past experience and consideration of the new high-pressure equipment, a lime and soda ash softener with supplementary phosphate treatment direct to the boiler was decided upon.

Control of the supplementary feed proved to be extremely erratic making constant dosage impossible with the result that the excess phosphate varied over a wide range as shown by the left hand chart of Fig. 6. Obviously the degree of control necessary to prevent scale formation was lacking and steps were taken to correct the condition.

As originally installed, the phosphate feed system is shown at the left hand side of Fig. 4. It consisted essentially of a phosphate mixing tank; a phosphate pressure tank filled intermittently by gravity and from which phosphate was fed to the boiler by the differential pressure between the feedwater and boiler pressures; and a Thrustor valve, operated intermittently by a demand contact on the boiler meter integrator to control the phosphate flow to the boiler drum.

Changes made in the system as a result of detailed studies are of interest for the control was so materially improved that results, as shown by the right hand side of Fig. 6, are uniformly constant, no difficulties requiring special attention have arisen for many months and operating results are very satisfactory.[2]

Investigations indicated that any one or combination of the following causes would prevent accurate control: (1) variation in feedwater hardness; (2) depletion of phosphate in the pressure tank; (3) variation in pressure differential between the feedwater and boiler pressures; (4) clogging of the flow control valve or nozzles inside the drum; and a (5) leaky Thrustor valve. These points are discussed below in the same order.

1. Variation in feedwater hardness is obviously a function of the softener. A method of feeding the chemicals into the softener in the form of a spray was developed to give very close control. The hardness varies between relatively narrow limits and is sufficiently constant to remove this as a cause of boiler water variations. In view of the

[1]For a description of this plant see By-Product Power for the Food Industry, POWER PLANT ENGINEERING, p. 644, November, 1937.

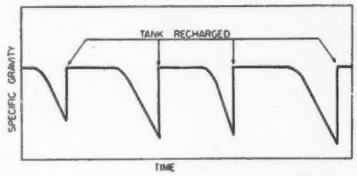


Fig. 1. Curve showing the variation of specific gravity of the phosphate solution in the pressure tank (see Fig. 4) with time

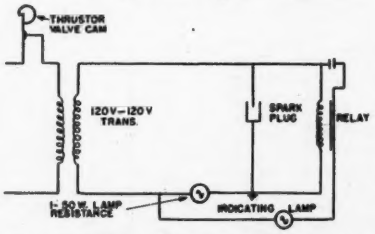


Fig. 2. Electric circuit for indicating depletion of the phosphate in the pressure tank. As long as the spark plug (see Fig. 1) is immersed the voltage across the relay (in parallel with the plug) is too low to close it and operate the signals

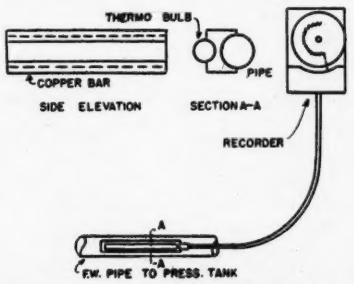


Fig. 3. Temperature readings were obtained by clamping a copper bar (formed to fit the curvature of the pipe and thermometer bulb) to the pipe. Typical charts obtained are shown by Figs. 6 to 8

[2]The author acknowledges the assistance and helpful suggestions of T. S. Crossan, Gulf States Utilities, Baton Rouge, La.

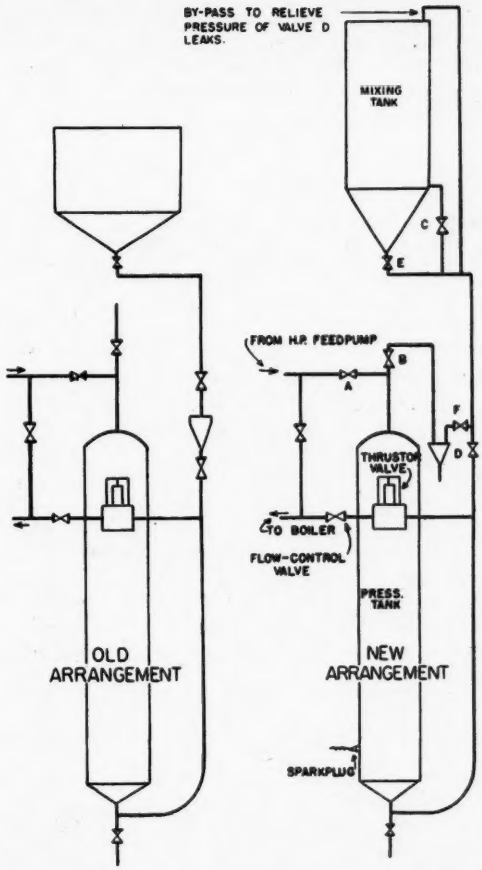


Fig. 4. Old and new piping layout for phosphate tank. In normal operation valve A is open, the others closed. To drain the mixing tank open valves E and F. To fill the pressure tank close valve A and open valves B, C and D. The spark plug shows when the tank is nearly empty. The electrical connection with the spark plug and Thrustor valve is shown by Fig. 3

importance of the softener in this system close attention to its operation is essential.

2. Depletion of phosphate in the pressure tank is a fertile source of erratic performance. To indicate depletion of the phosphate charge, samples were regularly drawn from the pressure tank and tested for specific gravity. However, the change was so abrupt at times, as shown by Fig. 1, that it was not always possible to know when the tank would empty. To give a positive indication of when the supply was getting low, a spark plug was installed in the pressure tank 12 in. from the bottom as shown in Fig. 4. This was hooked into the electrical circuit of a Thrustor valve, as shown by Fig. 2.

This circuit operates as follows: The transformer is energized by the action of the Thrustor valve cam located on the flow meter integrator spindle. As long as the spark plug is immersed in the PO_4 solution, the resistance across it is low and the voltage across the relay coil is insufficient to operate the relay. The resistance of a 50 w. lamp protects the transformer coil. When the spark plug is above the PO_4 solution the resistance across it is high and the increased voltage drop across the relay coil causes the relay to operate and light the indicating lamp. The relay will operate at

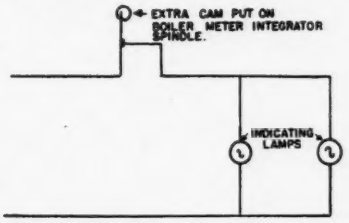


Fig. 5. Signal system, with one lamp at the control board and one at the sampling point, to insure sampling at the same time of each cycle. The cam is operated by the boiler meter

20 v. The transformer is used for isolation in an ungrounded a. c. circuit.

3. There was originally some variation in the pressure differential between the feedwater and boiler pressures, but this was corrected and is now held practically constant.

4. Clogging in the flow control valve was caused by iron hydroxide formed in the mixing tank. To eliminate this a mixing tank differing in physical dimensions from the original was installed as shown at the right of Fig. 4.

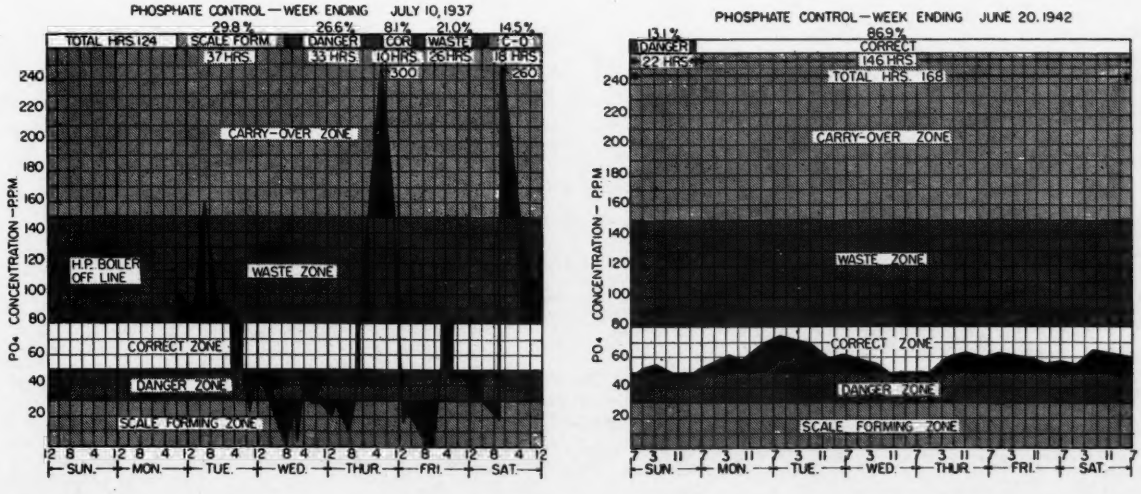


Fig. 6. Records of phosphate concentration are plotted each shift on a colored chart to give each shift engineer a picture of the operation. Zones are colored for easy identification; correct zone, blue; danger and waste zones, yellow; scale and carryover zones, red. At the left is a chart taken before the change showing practically no time on the correct zone. Right, a recent chart showing 86.9 per cent on the correct zone, and the balance only a slight amount low

More complete settling resulted and in general this tank has proven quite satisfactory. The floc formed is allowed to build up to the base of the cone before draining, thereby reducing the loss of solution to a minimum.

Clogging in the nozzles inside the boiler drum was caused by the formation of calcium phosphate. This difficulty was eliminated by: discontinuing continuous flushing; increasing the strength of the solution, and the adjusting valve was given a wider opening to cause the pressure drop to take place in the nozzles rather than in the valve. The time length of each shot was also reduced from 14 to 6 sec. Clogging in the nozzles has been entirely eliminated.

5. The Thrustor valve is controlled from the boiler steam flow meter to give the boiler a shot of phosphate for every 21,000 lb. of steam generated. If not tight, it does, of course, allow a small continuous flow of solution to the boiler which builds up a higher concentration of phosphate than required. This valve was found to leak and because of the inherent difficulty in making any double seated valve tight it had to be lapped in several times before bringing about the desired seating condition.

It was felt that if a record of events in the system could be made, it would be helpful for the solution of the problem. To get this record, advantage was taken of the change in temperature of the feedwater line to the pressure tank. A 2 ft. section of insulation was removed from this line,

(Continued on page 78)

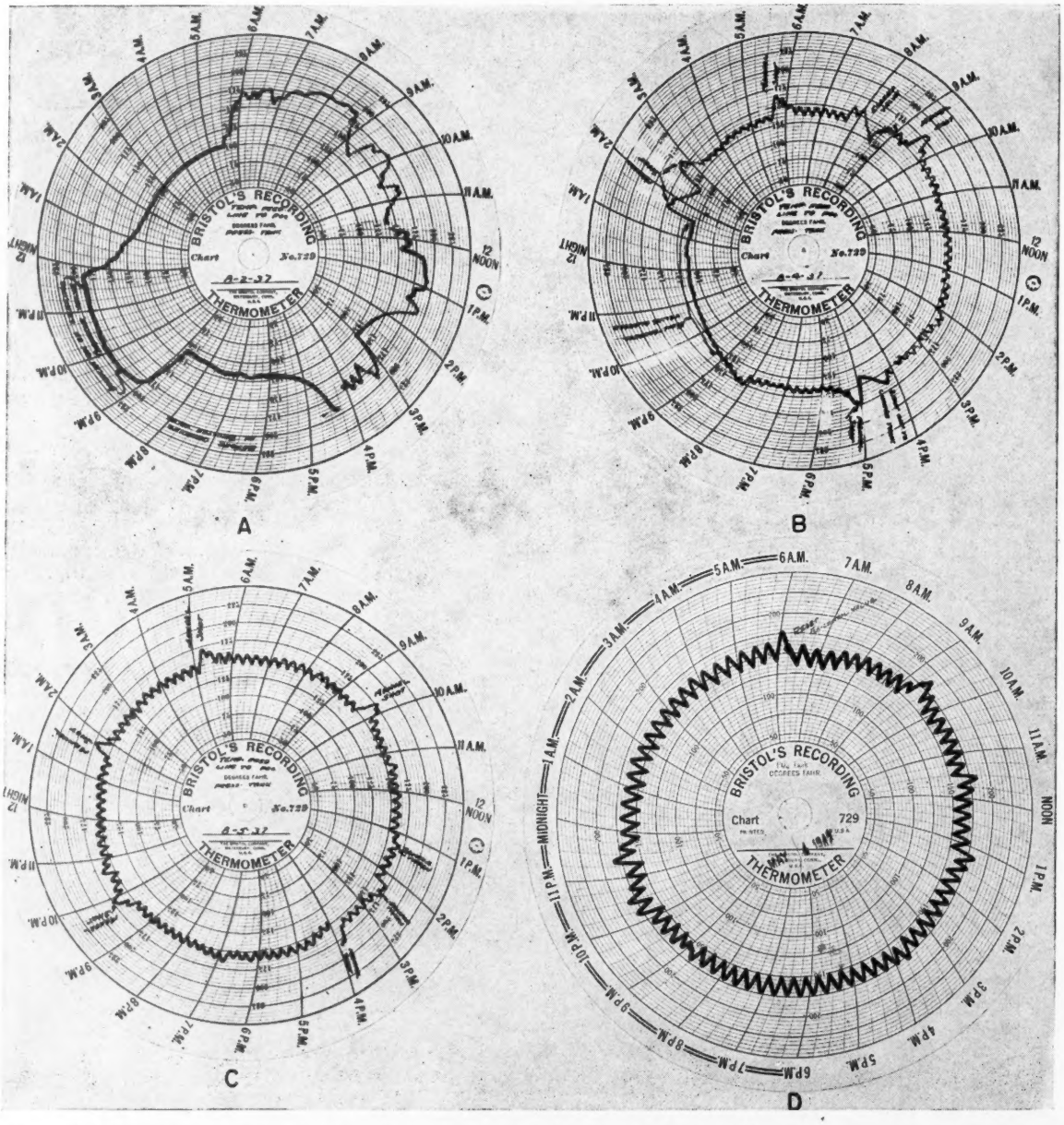
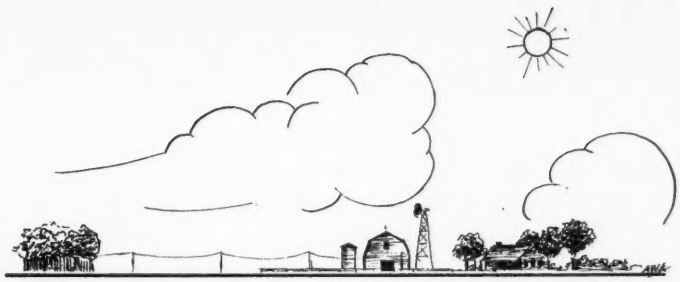


Fig. 7. Typical temperature charts taken from the feedline to the phosphate feed tank showing the improvement in performance. A, taken before the Thrustor valve was ground in, indicates valve leakage. B and C show later charts still somewhat erratic and requiring occasional manual adjustment. D is a recent chart with the equipment working practically without manual attention



Natural Humidity Control

by F. S. Graham

IN THE FIRST PART of this discussion[1] we considered, briefly, some of the facts about dehydration as well as the principles of evaporation and condensation. Now, we can begin to apply our knowledge of these facts.

Let us see now what happens in a refrigerator operated by mechanical equipment. Figure 2 shows the heat travel and circulation. The heat entering through the walls and otherwise transfers to the air inside. When it is warmed slightly a thermostatic arrangement of some type starts the refrigeration equipment in operation. This chills the air in the immediate vicinity of the cooling coils. As the air is cooled it condenses and becomes heavy. This cool air moved by gravity (Table I) falls to the bottom of the refrigerator and forces the warm air up as it displaces it. As the baffling guides the air a constant round of circulation is set up. The cold air picking up the heat in the bottom and in turn carrying it to the coils where the air is again chilled. As the warm air is cooled by the coils it also drops moisture on the coils due to the fact that it has lost some of its capacity in the chilling process. Table II shows the amount of water vapor in saturated air at various temperatures. The capacity of the cool air passing over the foods increases as it warms and it then picks up moisture from the foods. So we have here a never ending circle carrying off not only heat but moisture as well, which is part of the weight of the food. The coils here act in a manner similar to a small fan in causing the air to move. This circulation is forced only during the time that the machine is in operation and heat is being removed. From this it is easy to see that in the summer time we will have from 12 to 16 hr. operation. In the fall and spring we would have from 8 to 10 hr. and from nothing to 6 hr. in the winter months. In the average installation we have an excellent condition with the 8 to 10-hr. operation with extra dry conditions when it operates more, and damp with condensation when the compressor runs less. It sums down to one of two things. We must be satisfied to take the loss or change the conditions to eliminate this leech that is working on the red ink side of our ledger.

Let us now look at the refrigerator in use today and compare it with the ones that our grandfathers had. They are practically the same. The exception is that they are dressed up so as to be more pleasing to the eye. They are in fact just four walls with a top and bottom equipped with a bunker and baffle of some kind as far as operation is concerned. Look about yourself and you will find this to be true. It is the same old box with a new dress so as to be more appealing to the eye.

In the refrigeration machine and coils we have, in fact, only an equivalent of a cake of ice that never melts. The units have been refined so as to be more perfect mechanically but nothing more. It is true that at the time they are installed the baffling is sometimes changed so as to give a better average condition (Fig. 3). Some manufacturers have increased their coil surfaces to an extent that they can operate without the formation of frost or ice. Even with this, it still holds true that whenever warm air hits a cold surface its moisture contents will be dropped and we still are causing a dehydrating condition for the storage section of the refrigerator.

Now consider the coil and bunkering arrangement commonly in use. The refrigeration machinery manufacturers recommend an average air port of approximately

[1]Page 112, October, 1942, issue.

Table I. Weight per cu. ft. dry air, saturated air, water vapor and vol. of dry air at different temperatures

Under atmospheric pressure of 29.921 in. of mercury the volume at 32 deg. F. being 1.

Temp. Deg. F.	Lb. dry air	Lb. saturated air	Lb. water vapor	Volume dry air
0	0.0863	0.0871	0.00079	.935
12	0.0840	0.0841	0.00013	.960
22	0.0821	0.0823	0.00020	.980
32	0.0802	0.0805	0.00030	1.000
42	0.0784	0.0788	0.00044	1.020
52	0.0766	0.0772	0.00063	1.041
62	0.0747	0.0756	0.00088	1.061
72	0.0727	0.0739	0.00122	1.082
82	0.0706	0.0723	0.00167	1.102
92	0.0684	0.0706	0.00225	1.122
102	0.0659	0.0689	0.00299	1.143
112	0.0631	0.0670	0.00394	1.163

From Household Refrigeration by H. B. Hull published by Nickerson and Collins Co., Chicago.

In the first part of this discussion of humidity control presented in the October issue, Mr. Graham outlined certain fundamental principles of evaporation and condensation and showed how they affected the processes of heat exchange in a refrigerator. He also described, briefly, the elements of an average commercial refrigerator and showed the part each element played in the operation of the unit as a whole. In this second part of the discussion, he compares the conditions that exist in a thunder storm to the conditions in a refrigerator and shows, how, by such a comparison, we can learn to design our refrigerators properly. By means of the control so developed, it is possible to construct a refrigerator so as to obtain any degree of humidity desired. It can be adjusted to get a condition as dry as Death Valley or as damp as a London fog. This control is extremely simple and it can be applied to any refrigerator, large or small. Comments on this system of humidity control will be welcomed

Table II. The weight of water vapor in the atmosphere in grains per cubic foot at 100 per cent saturation under atmospheric pressure of 29,921 in. of mercury

Deg. F.	Wt. Grains
—20	0.166
—10	0.285
0	0.481
10	0.776
20	1.235
30	1.935
40	2.849
50	4.076
60	5.745
70	7.980
80	10.934
100	19.766
110	26.112

one-seventh the width of the refrigerator for single bunkers and approximately one-tenth for the double type (Fig. 4). The average slope is about ⅜ in. per ft. These values will give an operating condition in the storage section of a refrigerator during the different seasons as follows: spring and fall, fair to excellent; summer, dry to extra dry; winter, damp to extra damp (Figs. 6, 7, 8).

Next consider the food itself. The amount of heat necessary to remove from it is from two sources; the natural heat in it when placed in storage known as specific heat, and the heat which is produced by decomposition, or chemical heat. The latter, of course, is usually very small and is not considered at the time the equipment is figured. The amount of specific heat will vary in different foods. The greater the water content the more heat that it will carry. It is also true that items with the larger water content will show greater dehydration losses. Items such as fresh cut meats where new surfaces are being exposed to the dry air will lose a greater amount by evaporation.

There are many installations with poor coil coverage of the circulating air. This creates a condition which produces both dry and damp spots in the same refrigerator. Widely separated coils or restrictions of the circulation are often found to cause this condition.

Since we have considered some of the conditions in operation today, let us go back to the thunder storm and let nature show us what we should do (Fig. 5). At the front of the storm at point A the warm moisture laden air is being forced up by the weight of the heavier cold air that is dropping at points F. When seen at a distance this thunder head seems to roll thousands of feet above the rest of the storm. If we look under it at point B we will see no rain falling and it is only when we get back to points C and D that it is raining. At the points B and A, where the cold air from space F and warm air from space E are mixing, the warm air is being cooled and condensing the moisture in it yet none is falling there as rain, because the high velocity of the up-draft is carrying it up and over.

Now compare this action of nature to one of our refrigerators. In the summer, when the machine operates the greater part of the time, we have excessive forced circulation. The velocity of the air will carry all the moisture in the air up to the coils where it is dropped. This gives us a possible 20 to 60 per cent humidity in the storage section. Figure 6 will show the comparable conditions in the refrigerator to those of the storm in Fig. 5. With this we have excessive dehydration losses.

In the winter when the circulation is sluggish the moisture in the air is condensed so that it will be heavy enough to fall and collect on the foods. Here we have dry air going to the coils. (See Fig. 7.)

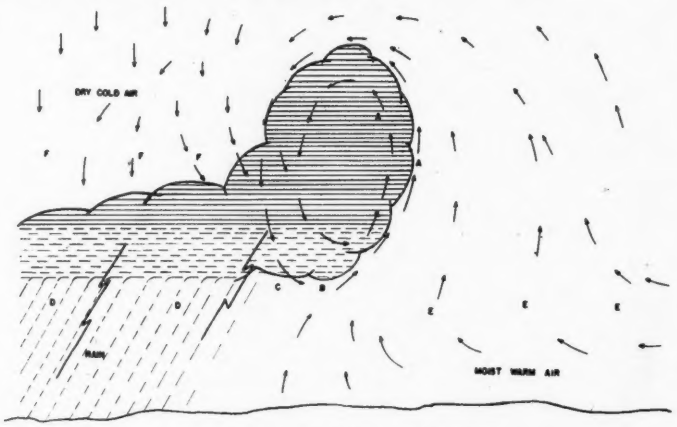


Fig. 5. Air currents in a thunder storm

In the spring and fall seasons (Fig. 8) the circulation is neither fast nor sluggish. Here the condensation is not fast enough to fall and yet it is too heavy to be carried by the up-draft. Notice that we do not have violent up-draft at point A or the falling of condensation at points C, D and E in the storage section. Only the excess moisture that is admitted on opening the door is carried off to the coils which are comparable to points C and D. Under these conditions the humidity average will be about 95 per cent. With this operation we have almost a perfect condition for food storage. Tests have shown very small losses from dehydration.

From these natural conditions in existence it can readily be seen that we must have circulation enough to carry off the excess moisture and yet not carry away too much. This brings us to the point of volume of air circulated over a period of time along with the amount of moisture added from outside sources in opening the doors.

As an example, consider a re-

*Figs. 1 and 2 appeared in the first part of this article.

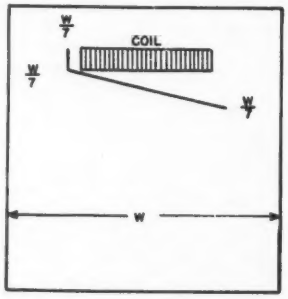
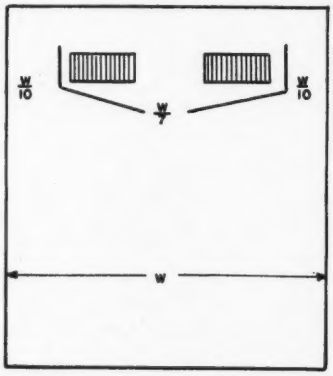


Fig. 3*. (Above) Standard bunkering arrangement for average refrigerator
Fig. 4. (Right) Double type average bunker



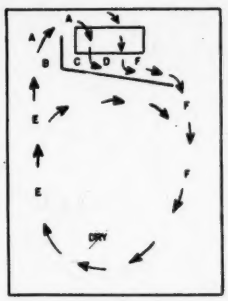


Fig. 6. Average refrigerator in summer season

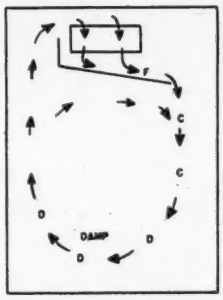


Fig. 7. Average refrigerator in winter

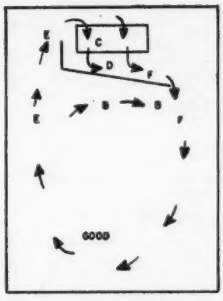


Fig. 8. Average refrigerator in spring and fall

Letters in Figs. 6, 7, and 8 show comparison to Fig. 5. A. Fast up-draft cold: B. Point of dynamic transfer: C. Heavy condensation: D. Medium or light condensation: E. Fast warm up-draft: F. Dry cold down-draft

frigerator 10 ft. high, 10 ft. wide and 10 ft. deep. Here we would have 1000 cu. ft. of space. Let us assume that during the spring season, when we have good conditions for our foods, there are six complete cycles of the air in the box per hr. That would give us 6000 ft. per hr. or about 60,000 cu. ft. per day since the compressor is running about 10 hr. per day during this season. Then, during the hot summer time when the machine runs 16 to 24 hr. we would have from 96,000 to 144,000 cu. ft. movement per day. This increased volume would mean an increased velocity which would give the air from 6 to 12 times the evaporating power of moisture from the foods. In the winter time when we have 6 hr. or less of operation we would have only 36,000 cu. ft. or less of air passing over the coils. During this period our evaporating power would be 6/10 or less so we naturally would have condensation. From this we may assume that proper volume and velocity of the air circulating in a refrigerator is vital to the preservation of foods.

The weight or size of the water vapor globules suspended in the air are in direct proportion to the speed of dynamic transfer of heat. The speed of dynamic transfer in turn is in proportion to the differential in temperature between two bodies of air that meet. In the refrigerator we may change the speed of dynamic heat transfer by changing the size of the air ports. The smaller we make the ports the slower the air will pass over the coil with a resulting cooler air to fall to the bottom of the box (Fig. 8). As the differential increases the speed of dynamic transfer is slowed down with resulting larger globules of water vapor. If we open the air ports and speed the volume of air flow the opposite effect will be accomplished (Fig. 6).

Since we have found the way to control the humidity by a natural means on any given day of the season it is easy for us to construct or alter our refrigerator so that as the seasons change we may control our air ports and get any humidity we may desire. We may also adjust it on any day so that it would be as dry as Death Valley or as damp as a London fog. The only thing necessary for us to do is to install a control of the volume of the air circulating within the refrigerated space. This cannot be any fixed amount for a number of refrigerators since they all do not have the same surface. The service or walk-in doors will be opened more on some units than on others and thus there will be a variation of moisture - laden air entering from which the excess moisture must be removed when it cools. The operator of each refrigerator will soon become accustomed to the necessary adjustments. About four to six adjustments a year, as the seasons change, will give satisfactory conditions. The conditions of stored foods is the best means of determining when adjustment is needed.

The bunkering should be built somewhat along the following lines (Fig. 9). The main bunker or pan should be built so as to allow equal air ports on each side which are approximately one-sixth the width of the box. The port dampers should be one-sixth the width plus 2 in. Insulate the bunker deck with 2 in. of sheet cork or equal. This is very important. Cover top and bottom with galvanized iron. There must be a circuit breaker between the top and bottom covers, otherwise condensation will collect around the edges. It is very important that the size of the warm and cold air ports be kept the same size at all times to prevent counter currents or eddies to form in the storage section. A turnbuckle arrangement that opens or closes both the port dampers at the same time has proven most satisfactory.

The port above the baffle should be one-sixth the width of the box with a horizontal air guide section extending to within one-half inch of the coil. This section prevents any air from passing under the coil instead of through it and is very important. The baffle and air guide may be made of 1 in. tongue-and-grooved spruce, or fir, tightly fit and need not be metal covered. Do

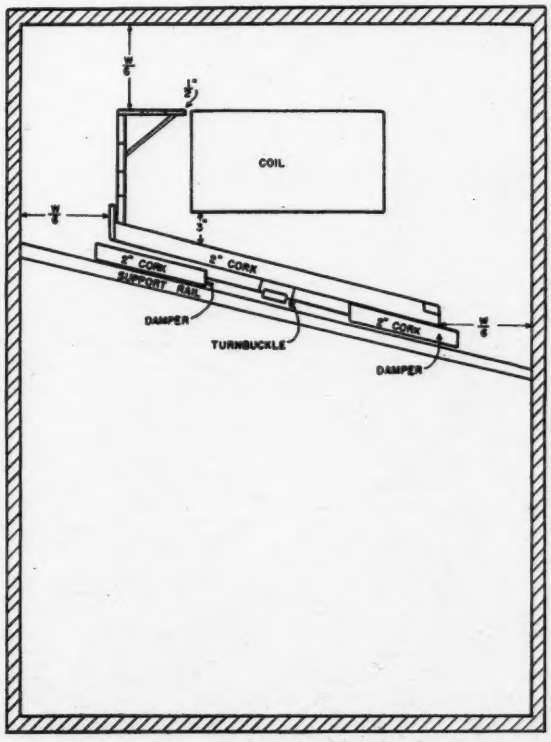


Fig. 9. Bunker and baffles. Showing adjustable arrangement to control natural humidity. For wide boxes, use double bunkers

not use a single thickness of metal only for the baffle.

The main deck of the bunker should be sloped 3/8 in. per ft. across the width and 1/10 in. per ft. across its length. The port dampers should be supported as near the deck as possible. A canvas apron may be used on each side to prevent air passing between the bunker and dampers. If the bunker is more than 7 ft. long, a support should be placed in the center. Many poor conditions are caused by a sagging damper. It must be remembered that the action of cold air is exactly the same as water. It always flows to the lowest point possible. The bunker should be at least 3 in. below the coil at its nearest point.

The location and size of the coils are important. As near to 95 per cent of the length of the box as possible should be covered by the coil or coils. This is to prevent any air passing through without coming in contact with the coil surface. The coil should be hung at least the distance of one-seventh the width of the box from the ceiling for best results if the fins are parallel with the baffle. If the fins are at right angles with the baffle 3 in. from ceiling is sufficient. On old installations where there is over 2 in. between the coils the space should be baffled so that all the air will pass through the coils.

The warm air port should always be located on the side of the refrigerator with the walk-in, or service doors. This allows the warm air entering the box from an open door to enter the natural up-draft of the circulation in the box.

If a refrigerator is located in a room that is not heated during the winter season it is necessary that a small heater be placed in it. This should furnish enough heat to operate the compressor a total of 4 to 6 hr. a day. In some localities this is not necessary if all the doors on the refrigerator including the top ice bunker door are left open at all times.

There are several ways of arranging the bunkering and dampers; in fact there are over 50 different ways. The one shown in Fig. 9 has been found to be the most successful and should be used wherever there is sufficient height in the refrigerator. If other types are used it will be well to keep the warm and cold air ports always the same size. In some instances

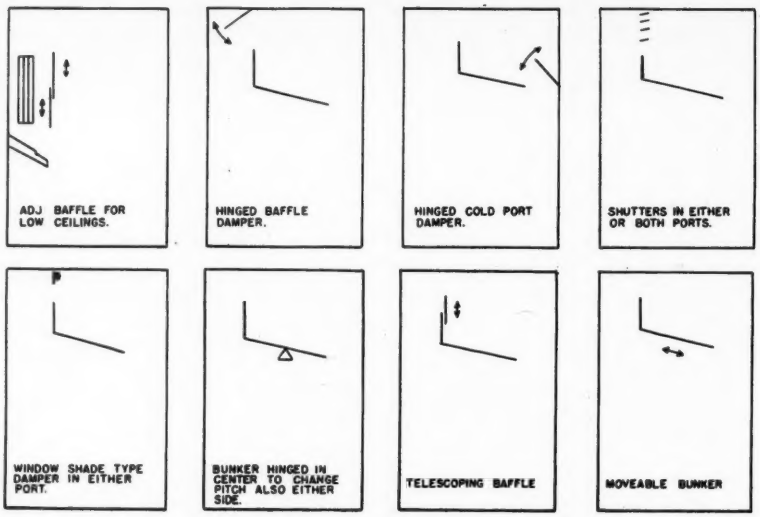

ADJ BAFFLE FOR LOW CEILINGS.
HINGED BAFFLE DAMPER.
HINGED COLD PORT DAMPER.
SHUTTERS IN EITHER OR BOTH PORTS.
WINDOW SHADE TYPE DAMPER IN EITHER PORT.
BUNKER HINGED IN CENTER TO CHANGE PITCH ALSO EITHER SIDE.
TELESCOPING BAFFLE
MOVEABLE BUNKER

Fig. 10. A few of the 50 odd arrangements of humidity control. For best results keep the warm and cold air ports even. If either has to be smaller than the other, it should be the cold port

shutters, hinged or telescope baffles and dampers have been used with good results. This was, of course, where the present bunker deck was in good shape and properly sloped. In low boxes where head room is at a premium some form of natural control can be arranged. Figure 10 shows some of the possible designs. In the purchasing of a new refrigerator the cost of an extra 2 or 3 ft. in height will pay for itself in less than one season in most installations.

Some of the results of installations now in use may be of interest. It was found in all cases where changes were made in old boxes that more than the cost of natural humidity control was saved in less than 1 yr.

On an iron-pipe-coil ammonia operated refrigerator where the coils would frost up solid in approximately 3 wk. a very unsatisfactory condition was found. It took the labor of two men a day's time about every 2 or 3 wk. to scrape the ice and frost off. When the coils were first cleaned the box was very dry, causing a loss of approximately 12 per cent in dehydration of cut meats. After the coils began to frost up this loss was less. It constantly diminished until about half of the air space between the coils was filled with frost. From that time on until the next defrosting, condensation took place which caused loss from slime. After replacing the bunkering system with a complete controlled bunker and baffles, the loss from dehydration was cut to ½ of 1 per cent and the coils operated on a self-defrosting cycle.

On an installation in a vegetable market the control was set to operate so that it would roll a fog in the refrigerator. Vegetables that had been on display until they were wilted so that ordinarily they would be discarded or sold at a big loss were placed in the box over night. The next morning they were as fresh and crisp as if they had just been gathered from the garden.

On a combination refrigerator and freezer box in a meat market the control answered a double purpose. A separate installation was made in the two sections. In the freezer section, which was carried at about 10 deg. above zero, the coils were defrosted after closing off the air ports with the control. An electric fan and heater were used to melt off the ice in about 2 hr. When the coils were ready to be placed into operation again the freezer storage had lost only 4 deg. in temperature. Before this time it was necessary to remove all the meats and scrape the coils. In the service end of the refrigerator, which was carried at 38 deg., a saving of 6 per cent in dehydration was made. This shop handled over 2 tons of meat per week and the shift from the red to the black side of the ledger was quite noticeable. Poultry that was brought out of the freezer and placed in the storage to thaw showed no loss in weight. They also thawed without showing dark spots. Every one was a natural clear color.

A 3-lb. steak was hung in another box to age. After 2 wk. it had lost only about ½ oz. in weight and was not discolored. When

placed alongside of a fresh cut steak there was no noticeable difference in the color of the two. On another test a 6-lb. roast was hung in a refrigerator equipped with natural humidity control. After 2 mo. aging it had lost less than 2 oz. in weight and was not discolored. Tests on various pork and beef cuts were made as well as sausages and other ground products with similar results.

On the purchase of a new walk-in refrigerator the cost equipped with a natural humidity control should not be more than $25 above an ordinary bunker that is commonly furnished. It costs very little more to build and install. On an old refrigerator the cost should not be more than $100 to $200 for the ordinary butcher's refrigerator. If we were very conservative in estimating the savings for an average shop handling 1 ton of meat a week we could figure 2 or 3 per cent on dehydration alone. Two per cent of 2000 lb. is 40 lb.; figured at a conservative figure of 20 ct. per lb. average for first class meats would be $8. Eight dollars a week for a year would net the tidy sum of $416. Not bad for the little merchant to change over from the red to the black side of the ledger. In fact it might pay his income tax with some left over for war bonds.

How To Make Leather Belts Endless

It is easy to make good endless belt laps if you know how. The simple rules given here will enable any mechanic with aid of a few tools to make endless laps in leather belts

By J. R. HOPKINS, Chicago Belting Co.

LEATHER BELTS should be made endless wherever possible. Endless belts cost less to maintain, wear longer, and give better performance than those fastened by other means. A leather belt can be made endless with a joint equal in strength to other laps in the belt. As a general rule, an endless lap construction should be used on wide belt for all important drives, high speed drives, and motor drives with fibre pulleys.

Making endless laps is comparatively simple to do and with a few tools any mechanic can be trained to make endless laps if the instructions here presented are followed. There is no mystery about the process—all it involves is to bring the laps to a feather edge, perfectly square, and to cement them with a good grade of cement. Only waterproof leather belt cement should be used. Old fashioned "hot" cement (non-waterproof) is no longer used as the belts will come apart under wet conditions.

The tools used are simple. To begin with a flat board is needed to work on. A set of clamps and rods such as that shown in the illustration is needed to hold the ends of the belt firmly in position. Hand tools consist of suitable scrapers, a belt knife, square, belt shave, lap opening hammer, pounding hammer, bench clamps, and cement brush.

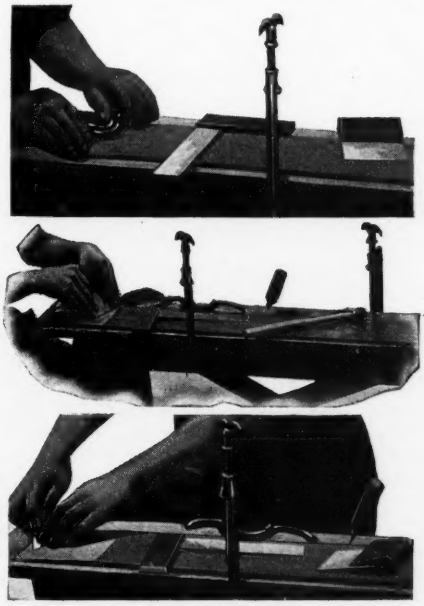


Fig. 1. (Left) Three views showing steps involved in making endless belt laps. (Top) Scraping with heel shave to make lap. (Center) Pointing lap with hand scraper. (Below) Finishing edge with belt knife

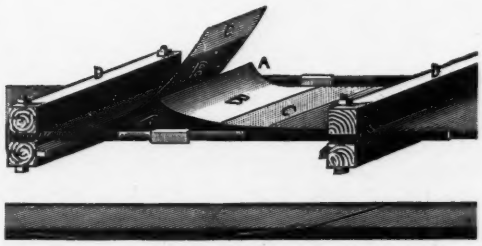


Fig. 2. (Right) Making the double belt endless lap using belt clamps. A goes against A, B against B, and C against C

Making the Laps

For single belts, make the laps 4 in. long for all single belts up to 4 in. wide. For a 5 in. wide belt, make a 5 in. lap, for a 6 in. wide single belt and for all single belts wider than 6 in., use a 6 in. lap.

For double belts, make the bottom of "A" lap 4 in. long for all belt widths. For the top or "BC" lap, make the lap 6 in. long from point to point for belts up to 6 in. wide. For belts wider than 6 in. make the lap as long as the belt is wide; 8 in. belt, 8 in. lap; 10 in. belt, 10 in. lap, etc.

(1) Clamp the end of the belt down, placing a board under it to scrape on.

(2) Take the "heeler" or heel-scraper and scrape down the lap to a rough point. Be sure the upper edge of your lap is squared with a set square. All laps must be absolutely square at both ends of the laps.

(3) Now take your belt scraper and bring to a feather edge point. The lap must be gradually tapered from top to bottom. Avoid a lump back of the pointd edge.

Fig. 3. Two views showing how to open up an old belt. (Top) Inserting screw driver to start opening the old joint. Do this carefully so as not to tear the leather. (Below) Use the hammer to finish the operation

(4) Now take your sharp belt knife and square the edge. Then take roughing tool and rough up the leather. Roughing counts a lot, so do a good job.

(5) Do the same with the other lap—and lay one lap on the other —called "matching up," to see that they are square, make an even thickness lap and one without lumps or humps in any part of the lap.

(6) Waterproof Cement is entirely different from hot cement. The solvent is very volatile and highly inflammable and the cement must be kept away from open flame, lighted matches or lighted cigarettes. This cement comes in semi-liquid form all ready for use. It is more like a varnish and is used cold.

(7) It is applied in two coats, the first coat being rubbed in carefully and permitted to dry for 30 min. The second coat is then applied and immediately stuck down. In applying the second coat cover only 6 in. of belt at a time and immediately stick down. Work fast on the second coat as it dries fast. Do not hammer the joint but place it between boards and apply pressure with bench screws. Let the belt joint dry for a good 3 hr. before using the belt.

8. It is best to permit the cement to "set" for 2 hr. for belts 8 in. wide or less and 3 hr. for belts 10 in. wide or wider.

To Open Up an Old Belt

Find the joint which was made when the belt was last put on and, with the point of the screw-driver, carefully open it, running the screw-driver under the point of the lap and working it towards the heel, taking care not to tear the leather.

If it is a double belt each ply of leather may have its own lap, or if it is a narrow belt it may have such a lap as is used on a single belt. Remove the belt to the bench; inspect carefully to see from which end it is most desirable to cut, in its relation to any other joints in the belt, and then bring the end on which it is decided to work nearly to the end of the bench, clamp the belt to the bench with bench clamps, and proceed to cut back the laps the desired distance.

MAKING A PHOSPHATE CONTROL SYSTEM WORK

(Continued from page 72)

approximately 6 ft. from the feedwater main, for a temperature recorder bulb. The distance of 6 ft. was taken so that conduction of the heat from the feedwater through the pipe wall would not maintain the selected section of the pipe at an even temperature. A copper bar was made to fit the curvature of the feed pipe on one side and the bulb on the other, then clamped to the pipe as shown by Fig. 3. The value of this arrangement as an indicator is shown by the charts in Fig. 7.

Time of sampling was found to be an extremely important factor. For instance, a sample taken immediately after a shot will show 30 to 50 p.p.m. higher excess PO_4 than if taken just before a shot. To time the sampling periods definitely, indicating lights were installed, one at the operating board and one at the sampling point. A second cam was installed on the boiler meter integrator spindle beside the Thrustor valve cam. The cam is designed to complete the indicating light, circuit shown by Fig. 5, circuit for 2 min. and go out ½ min. before the Thrustor valve opens. The sample is taken just as the lights go out.

Samples so taken are tested and the results plotted daily on charts of the type shown by Fig. 6. These give each shift engineer a clear picture of the control during each shift. Because of the color bands used, they indicate immediately the degree of control being obtained. The improvement before and after the above changes were made to indicate the improvement. These charts along with the temperature recorder are a permanent part of the system.

Tanks, piping and fittings are of plain carbon steel except for a section 6 ft. preceding the boiler drum. There the piping and fittings are of stainless steel. Immediately before the stainless steel region is a flanged piece of plain carbon steel pipe 12 in. long. This is removed periodically and examined for corrosion. No corrosion has been observed at this point, but the precautions are considered advisable because the metaphosphate in solution will revert to an acid salt (monosodium orthophosphate) on heating to a sufficiently high temperature. Before installing the stainless steel section, several temperature checks indicated that beyond 6 ft. the piping was out of the high temperature zone.

Continuous flushing, part of regular operation, was cut to intermittent flushing and with the installation of the stainless steel was discontinued entirely. A sampling line is taken off the delivery line which can also be used to blow back this line.

Figures compiled recently by the Standard Oil Co. of Indiana concerning the nation-wide scrap rubber drive showed that approximately 454,155 tons, as of October, had been collected in the country as a whole.

The Standard Oil Co. and its subsidiaries together collected 61,271 tons of scrap rubber or about 13.5 per cent of the nation-wide total. The amounts gathered by the individual companies were: Standard Oil Co. of Ind., 49,160 tons; American Oil Co., 7100; Pan-American Petroleum Corp., 2189; Standard Oil Co. of Neb., 1459; and Utah Oil Refining Co., 1364.

The oil industry is shipping scrap rubber to central receiving depots and rubber reclaiming plants at the rate of about 4000 tons a day.

Nearly half the heat value of the fuel used by large hotels is required for heating service water. The suggestions made by the author for rendering this service economically may be classified under three headings: Heating the water; storing hot water; and distributing and circulating the hot water. Temperatures desired, faucet sizes, methods of heating, temperature controls and fuel requirements for hotel hot water service are some of the topics treated

Economical Hot Water Service for Hotels

by Paul L. Geiringer, Licensed Professional Engineer, Newtonville, Mass.

FOR THE hot water service in a large hotel, the amount of heat or fuel required is about 45 to 50 per cent of the total fuel consumption. Economics achieved on this line are therefore as important as those which influence the room heating only.

The demands which may be set forth for the economic and satisfactory operation of hotel hot water service may be assumed as follows:

1. Have at all times hot water of the lowest permissible temperature level available in the bathrooms.

2. To have hot water available as near as feasible to the faucets so that no cold water has to be drained off before reaching the hot water.

3. To have water of higher temperature ready for the kitchen service.

Temperature Level of the Hot Water

One of the most important rules for economic operation of a hot water system is that it should be operated at the lowest temperature level possible. This temperature level should be fixed at about 130 deg. F. for the water leaving the faucets in the bathrooms. Every degree above this reduces the efficiency of the system without increasing its value for the hotel. This rule seems to be logical although it is seldom followed. It is absolutely wrong to assume that an equal amount of heat is required for a proportionately smaller amount of water if the water is heated to a higher temperature level.

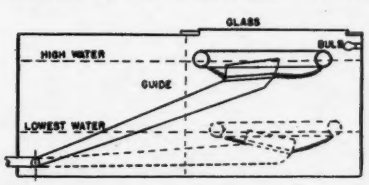


Fig. 1. Ring float devised to deliver only hottest surface water to service piping

Many hotels make the mistake of heating their service water up to 180 to 190 deg. F. on the belief that this is the peak of economy. Sometimes the maintaining of a higher temperature is required by inadequate installations, but even though a so-called economy in first investments has been achieved this does not mean economy in operation as well. To maintain at all times the lowest permissible temperature is the most efficient method of operation for large hotels and hospitals. In small private houses the difference in economy is not of such major importance.

The subdivision of the water into water for bathing purposes and water for kitchen service is the logical conclusion of these considerations. The water for the kitchen service should leave the faucets in the kitchen at a temperature of 150 to 155 deg. F. This temperature is normally adequate to rinse the dishes and to melt the grease on their surfaces.

The quantity of water delivered to the bathtubs and showers should be ample. In a system with a pressure head of 30 to 100 ft., ¾ in. faucets should be installed. If a lower head is used, sometimes 1 in. faucets are required. The quick filling of the bathtubs is one of the comforts which a finer house must provide for its guests. For bathtubs, ½ in. faucets are always too small, even if high pressure and high hot water temperature are used. These small dimensions are a nuisance. An increase of the outlet pressure to over 100 ft. is not advisable, because the maintenance of the valves is increased abnormally, and the increased splashing that results does not add comfort for the guests.

The valves at the lavatories can be ½ in. All faucets in the bathroom should be provided with secondary valves in order to throttle the pressure and to avoid splashing, and to preadjust the maximum flow of water.

These secondary valves are very important, and they help to prevent waste of the hot water. In the same way, the valves of the kitchen sinks have to be preadjusted by secondary valves. This is of highest importance, because all washing in the kitchen is done with running water and with the faucets fully open. Often 30 per cent of the water can be saved by the correct preadjustment of all the faucets of the house.

Economy in Heating, Storing and Distributing Hot Water

This economy must be considered collectively in an existing plant, but for the sake of better understanding we will discuss these three important parts of the overall efficiency separately.

Heating of the water can be

done economically in different ways:

1. By sending steam or hot water produced in the boiler through the coils of an instantaneous or storage heater.

2. By sending the water to be heated through an instantaneous heater submerged in the boiler.

3. By using the waste heat of the combustion gases by means of an economizer.

4. By utilizing all waste heat sources in the house for hot water production, as for instance, the return cooling water from air compressors and ice machines, or the waste heat of laundries.

All these different methods are economical. I generally prefer to use a storage heater with steam coils surrounded by water. Sometimes separate boilers are installed, which are fed with cold water, releasing the hot water to the main tank for distribution around the house, a system which is very good, but requires an efficient water cleaning and deaerating system in order to be really satisfactory. The maintenance cost of this system is rather high, and only in very few cases have I seen one operating really successfully.

Sometimes insufficient and badly designed distribution systems, inadequate boiler and tank capacity compel the mechanic to raise the temperature above the indicated temperatures. This brings us to another important part of the system, the storage tank capacity.

The capacity for storing hot water should not be too limited. In the morning and in the evening the peak load of a large hotel is so great that it seems to be absolutely unreasonable and inefficient to select boiler capacity and hot water heating equipment for this top-load rating. Plants built without adequate storage capacity will never be able to operate efficiently, and the first demand for improving the efficiency, therefore, is to provide a tank capacity large enough to supply the peak demand for at least ½ to ¾ hr.

The way the tank is connected with the hot water heater and with the distribution and circulation pipes of the house is rather important. The water settles and cools off in the tank, and also has a tendency to stratify. The hottest water will stay on the surface and the cooler water will be in the lower parts of the vessel. It is therefore of importance to draw off this hottest water to supply the house, and to keep the water in the tank continuously renewed. Otherwise it would be necessary to heat the water in the heater 10 to 20 deg. higher, which means an additional loss. It is therefore advisable to provide the tank with a large skimmer to which the mouth of the hot water take-off pipe is connected, so that only the top layer of hot water as supplied from the heater is drawn into the house (Fig. 1).

A good diagrammatic layout showing the heater, tank and distribution lines is given in Fig. 2. Sometimes the fresh water pipe and the circulation pipe are connected to the hot water tank; or the cold water tank, if situated at the same level, is directly piped into the hot water tank to provide circulation. I have found that this type of layout does not satisfy. It enormously reduces the capacity of the hot water tank because the tank has to be filled partly with cooler water and necessitates over-heating of the water.

Care must be taken to place the hot water tank high enough to take up the increased hot water volume. It has the advantage that the whole tank capacity can be utilized, and that the water produced in the heater enters the distribution lines at about the temperature to which it has been raised.

The insulation of the tank is important and the best type of insulation is advisable. Magnesia, rockwool, glass, or similar materials 2 in. thick are recommended. Wool is not suitable. The tank should be enclosed in a separate wooden box, or better, in a small house to which access from the roof has been provided. The tank cover must be insulated in the same way. The cover does not need to be detachable, but it should have a square manhole large enough for a person to enter the tank. This hole should be placed directly above the inlet to the ring float. It is convenient to have an electric light bulb within the water tank just under the manhole. The manhole should also be provided with an inspection window about 12 by 12 in. so that the functioning of the important ring float mechanism can easily be supervised. A high-and-low-water-level indicator, or better, an indicator by which the water level can be seen continuously in the boiler room, should be installed. Besides this, red and green lamps indicating the high and low water positions are of considerable value. The water temperature in the tank should be indicated on an electric thermometer installed in the boiler room.

The temperature control element should be placed in the steam line serving the coils of the heater so as to respond directly to the temperature of the water leaving the heater. The temperature sensitive bulb or feeler should be set to 140 deg. F. In the evening at approximately 9 o'clock I usually increase the temperature to about 160 to 170 deg. in order to be in a position

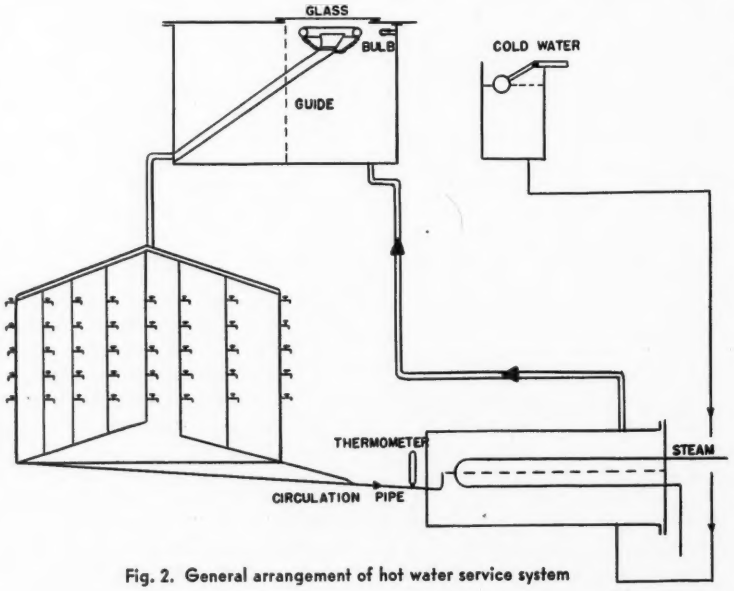


Fig. 2. General arrangement of hot water service system

to bank the boiler during the night. In this way the capacity of the tank is increased and the cooling losses during the night hours are balanced. An electric control with two feelers, one set for 140, the other set for 160 to 170 deg. F., are best suited for this purpose.

Another detail of the thermostatic control of large hot water heaters may be mentioned. I have observed that it is not enough to control the steam valve from only one point of the pipe line, but that it is better to have an auxiliary feeler in the middle of the heater tank as shown in Fig. 3. Feeler (A) may be set to 140 deg., feeler (C) to 110 or 125 deg. (The correct temperature can only be found by experience.) In order to close the steam valve (D) completely, both feelers must have reached their respective maximum temperatures. The purpose of this arrangement of two thermostats is to make certain that water of at least 140 deg. is always sent to the main tank on the roof. The thermostat operated by the feeler in the middle of the hot water heater makes certain that the water is at least partly heated when it reaches the middle of the heater. In this way the load is distributed over the entire heating coil and water leaving the heater is never lower in temperature than 140 deg. even during a period of peak load. If the peak load flattens out, the water will be a little hotter than required for a few minutes, but this small loss is negligible. The whole hot water system is protected, however, so that no cold water can be drawn into the roof tank where it might cool off the quantity of stored hot water to such an extent that the functioning of the whole system would be endangered.

The same effect can be obtained with two independent regulators. Thermostats must be of a type that cannot be ruined if the temperature of the water exceeds for a short time the maximum temperature set on the feeler.

The hot water for the kitchen can be heated to the appropriate temperature of 155 to 160 deg. F., allowing 5 to 10 deg. for cooling off in the pipe, with an instantaneous heater situated near the kitchen or in it. Tank capacity is not required for this operation as the amount of water is rather small compared with the total hot water consumption, and the temperature does not have to be raised more than 20 deg. F.

The distribution and circulation pipe system is important for supplying the hot water to all parts of the house. The most economic design is a gravity circulation system. It requires a minimum of fuel. If the layout is arranged as shown in Fig. 2 and the pipes have adequate fall and dimension, the circulation should be assured. Pipes extended too far horizontally provide some difficulties in circulation, and the flow of the water can only be maintained by means of a pump.

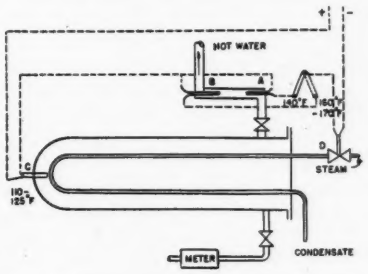


Fig. 3. Arrangement for controlling temperature of water from a steam coil heater

These circulation pumps (especially those for the hot water service) must be operated with considerable care. Their working time and circulation capacity must be cut down as far as possible, for otherwise increased fuel consumption would result.

During the summer months, I once checked the fuel consumption in a large apartment house with about 600 apartments and found that between the hours of 2 and 3 in the afternoon, when a negligible amount of hot water was used, a large amount of fuel had to be burned due to the operation of an oversized circulation pump, which drove the water very rapidly through the main pipes but almost none circulated through the branches. In this way the fuel consumption was nearly the same from morning to evening, because a large part of the heat produced was absorbed by the unnecessary circulation.

A few dead branch lines can never be avoided, but their number should be reduced to a minimum. So-called ring lines, where the water can circulate in different ways, are usually not very efficient, but can be made to function correctly if either line is throttled considerably. All vertical lines should be provided with valves of a type that can be used for throttling and for completely cutting off this part of the system. The common main return pipe should be attached to the heater approximately in the middle, not near the bottom as this arrangement gives the best circulation. To avoid back circulation some engineers consider it an advantage to enter 3 to 4 in. below the middle and to put a vertical discharge piece at the end of the circulation pipe inside the heater bringing the outlet up to the center of the heater. Nevertheless it will be found that some of the lower parts of the house will draw their water from the circulation and not from the flow pipe. This is not detrimental provided the circulation pipe is not attached to the heater at too low a level.

Thermometers so located as to indicate the temperature of the return circulation water at the heater, as shown in Fig. 2, are beneficial for checking the operation of the whole system.

Over-All Efficiency

The efficiency of boilers generating steam or hot water should not be less than 68 to 72 per cent, and if larger boilers are operated, an even higher efficiency should be expected. To transmit the heat through the coils of an instantaneous or storage heater to the hot water will cause an additional loss of approximately 4 to 5 per cent and the tank and distribution lines should not add more than 5 to 7 per cent further loss. A pound of oil with a heat value of about 19,000 B.t.u. will supply 12,000 B.t.u. for heating water, or a pound of coal with a heat value of 12,500 B.t.u. will supply about 7200-7500 B.t.u.

In winter, the cold water will enter the heater at a temperature of about 40 deg., in summer at about 60 deg. If the water is heated to a final temperature of 140 deg., we need per pound of water 80 B.t.u. in summer and 100 B.t.u. in winter. Therefore from a pound of coal it should be possible to heat about 90 to 95 lb. of water in summer, or from a pound of oil 140 to 145 lb. of water. In winter the figure will be a little lower, with one pound of coal producing not more than 70 to 75 lb. of hot water (about 9 gal.), and a pound of oil heating 120 lb. of water (14.5 gal.).

Measurement of Vibration With Electronic Instruments

THE CURRENT difficulty in obtaining instruments and equipment, irrespective of priority rating, has focused attention on the problem of extending the usefulness and application of instruments already on hand. One of the most fruitful possibilities in this direction is that of utilizing sound-measuring and analyzing equipment for the study of vibrational phenomena.

The problem of vibration in the operation of high speed power plant equipment is one that is not only extremely annoying but often very serious. Excessive vibration in any high speed machine is indicative of unbalance or weakness in some part of the structure and unless it is eliminated, the life of the machine will be shortened. In many instances the fundamental vibration of a turbine sets up harmonic vibration in connecting or adjacent structures and this may be damaging. It is obviously essential to be able to determine the frequency of vibration in all cases of this kind.

The study of the theoretical as well as the practical aspects of vibrations in mechanical systems has been greatly stimulated by the current emphasis of the mechanical side of warfare. The development of fast fighting planes, high-speed torpedo boats, and armored vehicles depends, in no small measure, on the ability to measure and to control vibrations in the machinery and structure.

This question of the measurement and analysis of mechanical vibration formed the subject of an interesting discussion in a recent issue of the General Radio Experimenter. Its purpose was to show that if suitable pickup mechanisms are available, certain existing types of sound level meters and sound analyzers can be used for satisfactory measurement and analysis of linear and torsional vibrations. Instruments of this kind can usually be found in most industrial laboratories of test departments.

Linear Vibrations

As an example of such adaptation, the Type 759-B General Radio, Sound Level Meter can be readily adapted for vibration measurement simply by replacing the microphone with a suitable vibration pickup. Since this instrument has a high input impedance, for use with a crystal microphone, a crystal pickup can be substituted directly.

Fig. 1. Measuring vibration in a motor with the vibration pickup and sound level meter

The reading of the sound-level meter will be a measure of the acceleration[1] of the vibrating member to which the pickup is applied because the crystal pickup, as commonly manufactured, is inertia-operated. More frequently, however, an indication of the *amplitude* of the vibration, independent of frequency, is desired, and occasionally a measure of vibration *velocity*. Fortunately it is a simple matter to convert the output voltage of the pickup to a voltage that is proportional to velocity or displacement. The voltage across the condenser in a series resistance-capacitance circuit is proportional to the integral of the impressed voltage at all frequencies for which the reactance of the condenser is small compared to the series resistance. Acceleration integrated once gives velocity, and the velocity integrated once gives displacement, so that a simple combination of resistors and condensers, together with a selector switch, can be used to provide any of the three types of response.

[1] This is equivalent to saying that, for a constant amplitude, the response is proportional to the sequence of the frequency.

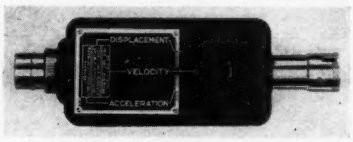


Fig. 2. View of the Type 759-P36 General Radio Co. Control box

The type 759-P35 Vibration Pickup and the type 759-P36 Control Box, designed particularly for use with the General Radio type 759-B Sound Level Meter are useful in this work. The design of the control box is such that flat response is maintained to a frequency very close to the resonant frequency of the crystal pickup. Calibration figures are supplied, so that the decibel readings of the sound-level meter can be converted to absolute values of vibration displacement, velocity, or acceleration. Figure 3 shows the over-all frequency response of a pickup, control box, sound level meter combination. The low frequency response is limited by the response of the amplifier in the sound-level meter, which, in its normal application, is not required to amplify frequencies below 20 or 30 cycles per sec.

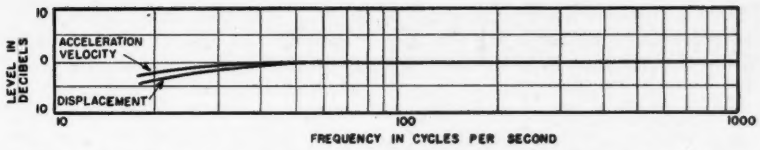


Fig. 3. Over-all frequency response of the vibration pickup, control box, and sound-level meter

In many applications a knowledge of the frequency of distribution and the relative amplitudes of the various components of the vibrational disturbance is important. If the type 760-A sound analyzer is used at the output of the sound level meter, the entire vibration spectrum can be scanned in a few minutes, and the frequency and magnitude of the significant components noted. In Fig. 4 is shown an analysis made with the equipment described above of the vibrations in a large surface grinder.

The type 736-A wave analyzer may also be used to evaluate the frequency components of the output voltage of the sound level meter. The selectivity of this analyzer, however, is so high that unless the vibration is very stable, it may be difficult to obtain satisfactory readings at higher frequencies. Furthermore, at the lower frequencies the band width of four cycles may be too broad to obtain a satisfactory separation of non-harmonic components that may fall very close together in frequency. In addition the instrument is somewhat bulky as compared to the type 760 and requires preliminary adjustments that are relatively critical compared to the simplicity of operation of the type 760.

Torsional Vibration

Of utmost importance in the design and testing of cam shafts, drive shafts, propellers, and other rotating mechanisms that transmit or deliver power is a knowledge of the frequency and amplitude of the torsional vibrations that exist. Only when means of measuring such vibration is available can an intelligent program be directed towards their reduction or elimination.

Perhaps the most widely accepted method of analyzing torsional vibrations is to make an oscillogram of the vibration, using a torsional pickup, integrating amplifier, and recording oscillograph. A mechanical harmonic analyzer is then used to obtain the magnitudes of the different components of the complex wave. Although this method is admittedly the most thorough (it yields the phase relations as well as the amplitudes), its use has been somewhat limited by the relatively high cost of the equipment involved and by the fact that considerable time is consumed in developing and analyzing the records. For production or maintenance testing, in particular, the latter objection can become sufficiently serious to rule out the method. Owing to the speed and convenience with which measurements can be made, the combination of sound level meter and analyzer offers an attractive possibility for use in conjunction with a torsional pickup. Tests made with a Sperry[2] pickup (No. 89246) indicate that entirely satisfactory performance can be obtained from a lower limit of 25 cycles to an upper limit determined solely by the pickup. This type of pickup

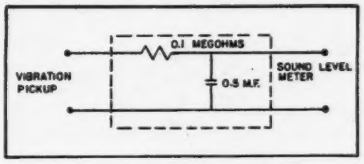


Fig. 5. A simple integrating network that can be used to convert the output of the No. 89246 torsional pickup to a voltage proportional to angular displacement

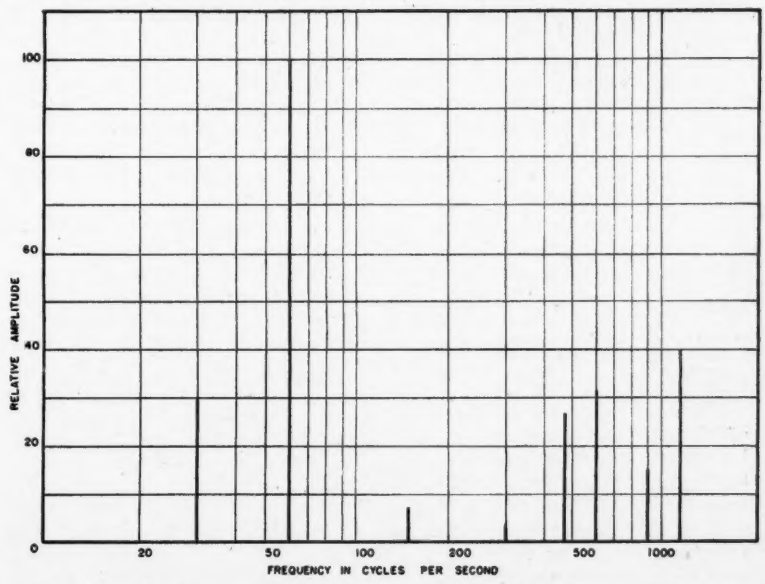


Fig. 4 (Above). Frequency analysis of the vibrations occurring at the exhaust horn of a vertical grinding machine. The large component at 60 cycles corresponds to the second harmonic of the rotational speed of the driving motor. The 1100-cycle component is caused by a resonance in the motor housing

[2]Formerly made by Sperry Gyroscope Co., now made by Consolidated Engineering Corp., Pasadena, Cal.

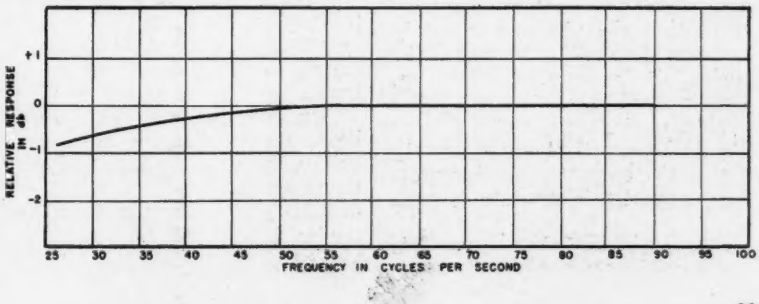


Fig. 6 (Right). Overall response of the torsional pickup, the integrating network of Fig. 5, and the Type 759-B sound-level meter. Data were not taken above 90 cycles because of the limitations of the mechanical calibrator used, but an essentially flat response should be maintained to about 1000 cycles, the upper frequency limit of the pickup

Fig. 7. The Type 760-A sound analyzer setup for analyzing torsional vibration. The pickup is shown on the end of the crankshaft at the extreme left. The sound-level meter is not shown in this photograph.

when mounted against a shaft is insensitive to the steady-state angular motion, but produces a voltage proportional to the angular velocity of any torsional vibration that is superimposed. To convert this voltage to a voltage proportional to amplitude of angular displacement, it is only necessary to integrate once, using a series resistance-capacitance circuit. A satisfactory integrating network can be made with a 0.1-megohm resistor and a 0.5 mf. condenser, as shown in Figure 5. The response of the sound-level meter with the network of Figure 5 interposed between pickup and amplifier is shown in Figure 6. A constant calibration amplitude of 2.02 deg. was maintained as the frequency of vibration was varied from 25 cycles to 90 cycles.[3] The minimum measurable amplitude is limited by the sensitivity of the pickup to about 0.1 deg. at a frequency of 60 cycles, while the maximum amplitude that can be measured is essentially limited by the maximum angular displacement that the pickup can safely accommodate. The response of the pickup is linear up to 10 deg. double amplitude.

Here again, the use of the Type 736-A Wave Analyzer (directly across the output of the integrating network) is feasible but, as previously explained, is not generally as satisfactory as the scheme outlined above.

While of course it cannot be pretended that the various arrangements discussed above can completely replace equipment specifically designed for vibration measurement and analysis, experience has shown that entirely satisfactory results can be had in the study of vibrations at frequencies above 20 or 25 cycles.

[3]This test was made in the laboratories of the Ranger Engineering Corporation, Farmingdale, Long Island, New York.

SNOWFLAKES LEAD TO STUDY OF WAR METALS

Because Vincent J. Schaefer, of the General Electric Research Laboratory, made a hobby of collecting plastic replicas of snowflakes, scientists now have a simple method of observing details of metal structure far too fine to be seen with the ordinary microscope. Since these metals are vital in the construction of essential parts of airplanes, guns, warships, and tanks, any observations which can tell more about them, and possibly how to make them stronger and better, are of tremendous importance.

Ordinary microscopes, using light, magnify at the most some 2500 diameters. Increases of this figure are not possible, for then the details are too much smaller than the light waves with which they are viewed. This limitation is removed in the electron microscope where electrons act like waves of much shorter length. They can be focused with lenses, not of glass, but of electrostatic fields inside charged metal doughnuts, or by magnetic fields formed by properly shaped magnets.

In this way, electron images, as much as 50 times the magnification of the best enlargements in light microscopes, can be made. The image is visible on a fluorescent screen, which shines where the electrons strike. Or the images may be recorded on a photographic plate.

Electrons have little penetrating power, so the entire microscope must be exhausted of air. Also, the specimen being magnified must be very thin, otherwise the beam cannot get through. Unfortunately, samples of metal cannot be made thin enough to be examined in this way, but complicated methods have been devised to eliminate this.

However, Mr. Schaefer, who has been associated for a number of years with Dr. Irving Langmuir in his work on thin films, had been reproducing minute details of snow and frost crystals by "casting" them in a film of Formvar. As a hobby, he has made a large collection of such crystal replicas, obtained during winter snowstorms, formed on glass on cold nights, or even made in the ice box in summertime.

After some experimentation, he found why it had been difficult to get good films directly. Even with the most careful cleaning, a few grease molecules will soon settle on the surface, and these interfere with the removal of the film. This was overcome by cleaning the surface immediately before the film-forming material is applied. This consists of a solution of Formvar, a plastic, in dioxane, a commercial solvent. After the dioxane evaporates, the specimen is immersed in water, and the Formvar film, only a half-millionth of an inch in thickness, is stripped away. Less than five minutes after the specimen is received from the polishing room, it can be examined in the electron microscope.

High places on the metal are thin spots on the Formvar film, while valleys come out as thick places. These scatter the electrons more, and appear darker in the final image. This is also the way the specimens appear in the usual metallographic microscope, where high spots are light, and valleys dark.

The PRACTICAL ENGINEER *and* ELECTRICIAN

ANDREW W. KRAMER, EDITOR

CAPTAIN R. H. MORRIS
U. S. ARMY AIR FORCES

WE have been trying to get this picture ever since Dick Morris entered the army in September, but he is rather modest and we had a hard time prying this one loose. However, here it is. It is a very good picture of the Captain and we are proud to be able to present it here.

Mr. Morris was born in North Dakota. He received his education at the University of California and was graduated from there in 1920 with the degrees of A.B. and B.S. in Mechanical Engineering. Following this he did graduate research work at M.I.T. In 1917 he was marine machinist at the Los Angeles Shipbuilding and Drydock Co. and in 1918 entered the U.S. Army Signal Corps. He was electrical draftsman with the Bethlehem Shipbuilding Corp. in 1919 and served as Junior Engineer in the International Mercantile Marine in 1921. He entered the Engineering and Sales Department of the Worthington Pump and Machinery Corp. in 1921 remaining there until he became Assistant Power Engineer of the United Verde Copper Co. at Clarksdale, Arizona. In 1926 he joined the staff of Power Plant Engineering.

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A Section of Power Plant Engineering Devoted to
PLANT OPERATION AND MAINTENANCE

Technical Publishing Company
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Maybe We're All Nuts

The unknown hero of this narrative was moderate in his wants. All he wanted was $1500 to work out some ideas he had, one of which involved the running of automobiles. Now of course, there is nothing strange about running automobiles these days, providing you can get gas. Much depends upon the latter fact and that is where our hero steps in—he doesn't need any. This is a true story

By ANDREW W. KRAMER

A FEW DAYS ago a man came up to see me about an "idea" he had and which, apparently, he wanted to see developed; at least that was my first impression. I had never seen him before—he just wandered in and perhaps he merely wanted to talk to somebody about his ideas. He was a small, rather meek, elderly man, in his sixties probably, neatly dressed, and deadly serious.

His meek exterior, however, poorly belied the mighty mental processes that went on in his brain nor did it imply the import of the matter he came to see me about.

Unfortunately, or perhaps fortunately, I was unable to avail myself of the "proposition" he offered me and in the end the result of his visit was negative, but I am violating no breech of confidence in recounting here the nature of our conversation.

He lost no time in coming to the point. He could, he believed, keep a tank of water, say 50 or 100 ft. long and 10 to 20 ft. deep, in continuous circulation.

Coming out of a clear sky, the full impact of this disclosure was lost upon me and for the moment I was at a loss for words. I gazed at him rather blankly, waiting for him to proceed.

"Is that so?" I said, just for the sake of saying something. "That's fine."

"Yes," he said. "I am sure I could do that."

Up to this point I must confess I was still unimpressed; the fact was I did not grasp all the implications inherent in his statement.

After a somewhat embarrassing pause, during which we both stared at each other blankly, I finally asked what the purpose of such a tank of circulating water might be. It probably was not a very intelligent question.

"Well," he said, "it could drive hydraulic turbines."

There it was, out in the clear, with no strings or accoutrements of any kind attached, and yet, even then, I failed to grasp the significance of the idea. My mind was slow that day.

Gradually, however, I began to realize what my visitor had in mind and as my mental dullness gave way to amazement I became still more speechless.

"To be sure," I finally managed to say. "I had not thought of that. But if you can do that you certainly have got something. Have you ever built one of these tanks?" All this time I was thinking of the money spent on Grand Coulee and Boulder Dams.

He said he had not—it would cost something like $1500 to build one—and somehow he had not been able to get so much money together. He was looking for somebody to finance the experiment, in fact he thought we might be willing to advertise it.

"It certainly is a remarkable idea," I said. "I have never heard of anything quite so remarkable."

He seemed to agree to this and my obvious admiration gave him the courage to tell me more. He had other ideas, he said, in fact he felt that he probably had more ideas than any other person in Chicago.

"I don't doubt it," I commented, still a little bewildered.

"Yes," continued my visitor, paying little attention to my remark. "For example, I think that I could run an automobile without using any fuel whatever."

"You mean with no oil or coal or anything?" I asked hesitantly.

"Yes," he smiled in his meek yet superior way. I am sure he felt a little sorry for me.

I needed a little sympathy by that time. The impact of two such startling disclosures had shaken my composure and I could only say, "Well, if you can do that, you really *have* got something. But how do you know your idea will work?"

It would work, he assured me. He knew that. As a matter of fact he had worked 30 yr. on the idea.

He finally went away—a little sadly I thought. I could not help him very much. If he cared to write up his ideas and submit them for publication I told him we would gladly consider his writings, but explained that if we published such articles, his ideas, of course, would become public property.

To this he did not react favorably, nor did he feel that he could avail himself of my offer to give him advice regarding the feasibility of his inventions.

"You would have to have an outline or a description of some sort, wouldn't you?" he asked.

"Yes," I told him.

He shook his head meekly and smiled. No, he could not do that because if he did that he would have to disclose the nature of his ideas.

So he left.

This happened several days ago and ever since I have regretted letting him go. For the more I think of it, the more do I realize that here was a man our country, in its hour of need, could well make use of. After all, $1500 is not a lot of money these days, and I am sure that Jesse Jones could be induced to put up that amount if the purpose was explained to him. Indeed, this man had in his hand, or perhaps more correctly, in his mind, the answer to all the world's problems.

He can make an automobile run without gas! Think of what Mr. Hitler would give for the secret of that idea. Why are Hitler's armies headed for the Caucasus? Why is General Rommel trying to find a way through North Africa to the Middle East? Largely for the oil they can get there to run their tanks and airplanes and other motorized equipment.

My visitor at one stroke could make all such conquests unnecessary. In this country all the difficulty and argument

A man came in to see me

over gas rationing would disappear overnight. We could haul our cars out into daylight once more, and drive them anywhere, on nothing at all. All the A, B, and C cards could be thrown to the wind and we could drive anywhere, rubber and 35 mi. per hr. permitting.

And, there is the water tank idea—that certainly has possibilities. My visitor was reluctant to say very much about the nature of this scheme but was confident it would work.

He had never gone to college, he explained, but I told him, and he seemed to agree, that that could not have been any serious drawback in his case. I did not add that I believed that, for him, a college education would have been a mistake. In college they would have nipped his ideas in the bud and the chances are he would never have pursued his thinking to such practical ends. He might have spent the rest of his life composing mathematical papers filled with cabalistic notation which in the end prove that something or other is equal to $\sqrt{-x}$. At least an automoible that runs on nothing is a practical end to one's thinking; quite as useful as the $\sqrt{-x}$ and none the less glamorous.

The thing I liked about this man was that he was sure of himself. There were no "ifs" or "buts" about his thinking. He was not assailed by disturbing laws of physics or thermodynamics. Conservation of energy or such things had no place in his cosmos, indeed his thinking was anything but conservative. If he only had $1500 to build a tank.

If there were more people like him in this world, and less of Mr. Hitler's ilk, it might be a more pleasant place to live in. Perhaps the $1500 spent on his tank would be wasted—the scheme might not work, despite his confidence—but, certainly, it would be as sensible to spend $1500 for such a tank as it is to spend $15,000 for another kind of tank that only spells destruction and death. At least this tank could serve a useful purpose as a swimming pool, which is more than can be said of the kind we are turning out in such great numbers today.

Maybe this man's thinking lacked logic, maybe it was unorthodox but a careful analysis of the world situation todays fails to convince me that the rest of us are less "nuts."

Redeemables

By ATOMIZER JOHN

BURNER ORIFICES. When new burners or burner heads are received the exact size of the orifice and the drilling angle should be determined and recorded before installation. Each time the burners are cleaned thereafter the orifice size should be checked because any enlargement of the orifices will change the efficiency and characteristics of a burner.

Where space permits an oversize orifice can be drilled out and tapped. A short piece of threaded heat resisting rod screwed into the tapped hole and drilled back to proper size will in many cases make the burners superior to the original ones provided the threaded rods do not protude past the inside surface of the head. Where orifices are too close for oversize drilling the orifices can be welded closed and drilled back to proper size.

BURNER ASSEMBLY. Liberal use of dry graphite or graphite and high temperature oil when assembling burners is the best assurance of easy dismantling later.

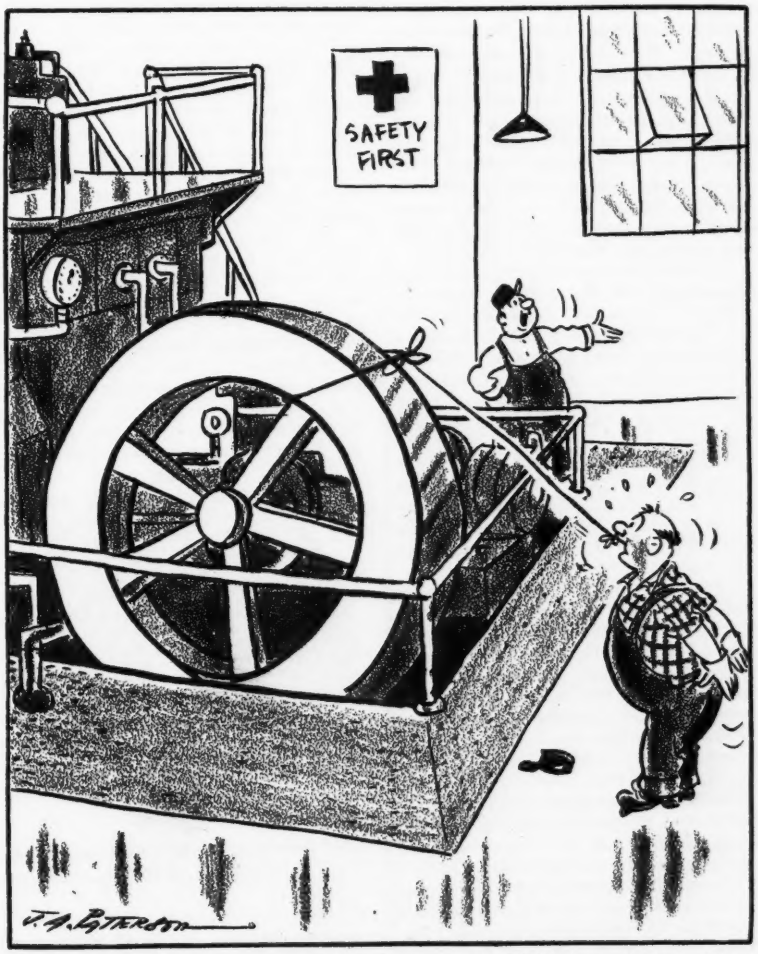
BURNER FUELS. Burners, regardless of the type of fuels used, are designed for specific operating conditions. For best burner efficiencies it is not only necessary to keep the burner in first-class condition, but the fuel the burner was designed for must be used. Exact fuel specifications for which the burners were designed should be obtained from the manufacturer, this should be the determining factor in buying fuels for the burners.

FUEL OIL. Heavy fuel oils should not be bought on A. P. I. gravities and heat contents alone. The viscosity is a deciding factor on the burnability of an oil when discharged from the burners. Cracked heavy oils give higher heat contents per barrel than the lighter oils.

When burning heavy cracked oils it is necessary to determine where the temperature-viscosity curve starts leveling out; the oil temperatures should be held within this temperature zone for oil temperatures beyond this causes cracking of the oil in the burner heads, and eventually leads to plugged burners, or burned heads.

FUEL OIL PUMP. Check the pressure on the suction of the fuel oil pump in case the pump "loses suction" when the oil temperature passes a certain point. If the pump begins acting up before the oil is heated hot enough to burn efficiently the fuel storage tank should be elevated high enough to put a positive pressure on the pump suction. If there is a positive pressure on the pump and the pump binds and will not pump, check with the refiner of the oil and determine whether a less volatile blending stock can be used and still meet specifications.

GAS REGULATORS. Before a gas fuel regulator or control is put into service, it should be determined whether the actuating medium opens or closes the control. There are some exceptions, but in majority of the cases the regulator or control should be set so a failure of the actuating mechanism or medium, the valve will not go completely closed, thus leaving a pilot flame in case the fuel is cut back on. A box car seal is



"Okay, I'll turn her over for you, this time—but I still think you had ought to go to a regular dentist—Doc Snavely calls me a scab"

a very handy means of locking the valve.

EMERGENCY WHISTLE. Where outside duties require one or more men to leave the operating zone a small whistle with a code call for each operator may be noisy but it may avert having to make an emergency change-over shorthanded.

GAS BURNER GAGES. A pressure gage set between the regulating valve and each individual gas burner will not only make it easier to balance the fires across the flame front but will tell the condition of each individual burner as to cleanliness and orifice condition.

GAS HEADERS. Running a tube cleaner motor and head through gas headers and feeder lines about once a year will eliminate much of the burner clogging from scale.

ORIFICE DRILLINGS. When drilling multi-orifice oil burner tips, one orifice drilled with 15 to 30 deg. less angle than the other orifices will, in many cases, improve the characteristics of the tip.

MOISTURE. Moisture in fuel oil or steam or both may mean the difference between good or poor operation of a steam atomizing oil burner. Steam and fuel oil should both be checked occasionally for moisture.

REFRIGERATING PRACTICE

Instruments Avoid Arguments

Use of recording pressure gage saves water in ice plant and eliminates arguments encountered between the operators

By LEON S. LYON

THE MORNING I first called on the chief engineer at the ice plant I found him rather "grouchy", just having had one of his troublesome sessions with his assistants and the usual arguments between the day and night shifts—each complaining that the other fellow was not pulling his share of the ice.

Looking around I soon found that the set-up was about as usual in our district, that is, with high pressure on the city mains. They had an auxiliary low-pressure open tank that held just enough water for four cans with a float in the auxiliary tank allowing it to fill to just the right level and to waste no water.

The cans were lifted by a hoist handling four cans. When the cans were dumped, a quick opening valve allowed a quick and full flow from the auxiliary tank, each can filling to about the correct level.

Another complaint from the powers was that water was being wasted.

Times were about like they are now, the labor that the Chief was able to get, was whatever he could get; and especially on the night shift there seemed to be a tendency for loafing, thus making the output of ice below normal.

My suggestion was a low-pressure recording pressure gage tapped into the bottom of the auxiliary tank. Then, I said, "Each time the tank is emptied the pen will go to near zero, giving a complete down stroke for each dump. If water is being wasted it is because someone leaves the quick opening valve open and the cans do not find water for the next dump, therefore they have to wait for the tank to fill, thus this recorder will give you an accurate check, not only on the ice pulled, but also acts as check on water waste."

This was not much different than that found in many plants, however while many let the controversy and waste go on for years, this chief was able to get the idea across to his superiors and after the first few days of operation the controversy ceased, for as on the sample charts we drew the complete history of each days' operation.

In the years that have since passed, I have traveled far and wide, but recently being in that city and near the ice plant I dropped in.

The old chief did not remember me at first, but when I mentioned that old recorder which I noticed was still in use, he warmed up at once. The price (they had debated upon that as high) was about forgotten, as well as the salesman who sold it, the old compressor was gone and replaced with a new model. The old ice tanks had been gone for years and very little of the former equipment was there, but

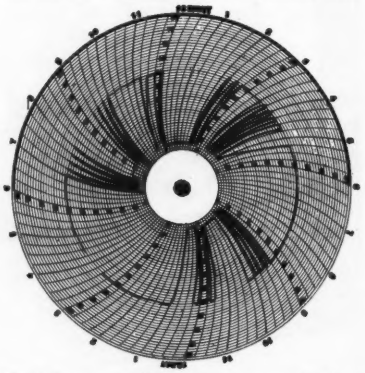


Chart from recording pressure gage showing can filling operations

the old recorder was, as he put it, "part of the firm", giving an account of the delays which had to be explained, and giving a daily check of ice pulled. It provided a record so reliable that outgoing records had to check with it. The cost of about $60 had long been written off, there had been no other expense except that for a couple of cleanings of the clock and a couple cents a day for charts and ink.

With our present call for conservation of time, fuel and power, the high cost of labor and other troublesome details, and even though it may mean a little bother in getting the proper priority, this instrument application will put the "E" in efficiency, except possibly in such cases as in another and similar old plant, now defunct, where the chief engineer, an old Dutchman, said, "I don't need no scheck on me".

Steam Pump Operates On Compressed Air

By HAROLD S. SYKES

IN THESE days of priorities the following idea may be as worth while to engineers in other small ice plants as it has been to me, so I pass it along for what it may be worth.

Some time ago we began to have difficulty in sucking out the cores of the partly frozen cakes in our raw water ice plant. Investigation soon revealed that the coring pump (of gear type) was so badly worn out that it was not worth bothering with. Upon looking over our junk pile we discovered a small duplex steam pump that was in pretty good shape, and it was soon ready to run. Unfortunately we have no high-pressure steam to operate it, but there is a lot of air at 125 lb. pressure, which is used in other departments of the plant.

The steam pump was installed in place of the old gear pump and is operating day after day with air as the motive power. The men pulling the ice remark that it is the best coring pump they ever used, as it causes no trouble whatever. The air line was brought to the ice deck where a shut-off valve was installed. Then the line doubled back to the pump in the basement, with another valve at the pump. This second valve is set for the proper speed and the one on the deck used for starting and stopping.

There has been no trouble with lubrication of the steam (now air) end of the pump, as a small automatic oiler was installed, the latter driven by an arm bolted on to the valve gear. We use a mixture of steam-cylinder and air compressor oil as lubrication, with no apparent wear. So, when better pumps are needed, it sometimes pays to look over your old scrap pile.

* * *

Excessive pressure; poor welding; corrosion; pipe strains; vibration; a sudden blow; failure of soldered connections; brittle metal; expansion and contraction; and many other causes contribute to failure of pipe and fittings. Because it is impossible to detect incipient failure, bolts and joints should never be tightened while under pressure for the added strain may cause a break.

LETTERING ON ENGINEERING DRAWINGS

Those having to deal with the problem of getting out engineering drawings these days will be able to appreciate this article by the chief draftsman of the Consolidated Edison Co. of New York, Inc. It describes two methods of lettering drawings that can be put into use in all drafting rooms and that will result in faster, neater lettering. The use of an Elliott Fisher billing machine may be of particular interest

By F. P. KUHL,
Chief Draftsman, Consolidated Edison Co. of New York, Inc.

LETTERING ON engineering drawings is essential to the finished job. It will enhance or detract from the appearance of the work depending on the proficiency with which it is executed.

Fast, symmetrical free-hand lettering, the good draftsman's stock-in-trade, is the result of many years of practice. Such draftsmen are hard to find today.

Therefore, mechanical means must be substituted wherever practical to obtain presentable and legible drawings. Use of mechanical guides is an excellent means of obtaining precision lettering, but is likely to be too slow for general use.

A new type of guide is illustrated in Fig. 1. It is semi-mechanical and employs fixed slots for controlling the height of letters. This guide may also be made in the form of an adjustable parallelogram from which a letter of any desired height may be obtained within the limits of the parallelogram side arms.

With the "slot type" guide no attempt is made to keep the vertical lines of each letter parallel. It is possible to keep the height of all letters equal by simply allowing the lettering medium to strike the upper and lower limits of the slot in the guide, thereby keeping lines of lettering parallel.

Spacing between lines of lettering is obtained by the use of guide lines which are engraved above and below each slot on the guide, thus eliminating the use of guide lines on the drawing.

Character styles may be standard or individualized and are limited only by the imagination of the user. Some styles are shown in Fig. 1.

While this method does not produce the precision letters obtainable from totally mechanical guides, the final result is neat and workmanlike, and after a little practice the lettering speed is comparable to or faster than that obtained free-hand.

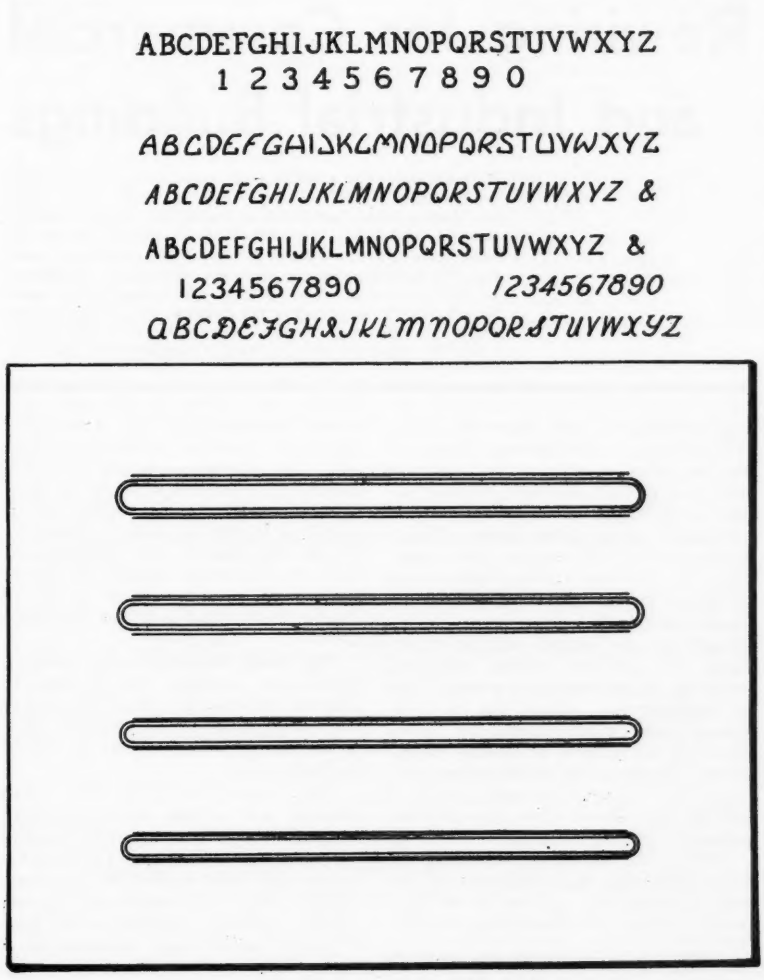


Fig. 1. Slot type guide and sample lettering

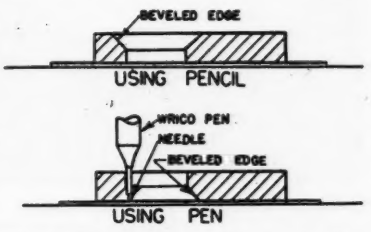


Fig. 2. Cross sections showing use of guides with either pencil or pen

Guides Are Easily Made

These guides can easily be made from some transparent plastic material such as "Xylonite" which is the material often used for triangles and French curves. Sheet material about ⅛ in. thick is most suitable; cross sections of the guides showing their use with either pencil or pen are shown in Fig. 2.

When used for ink work, a Wrico pen should be employed and the guide should be used as shown. No blotting can occur because the sleeve of the Wrico pen projects below the slot and into the void made by the beveled edge.

Another method is the use of the typewriter. A stenographer or typist may, from dictation or the draftsman's longhand notes, do complete or partial lettering jobs on drawings. However, a machine which will accommodate large drawings is not only usually high in cost but the visible working area is very limited. In large engineering organizations the acquisition of this type of equipment is easily justified by the volume of lettering performed, but in smaller organizations of eight or ten draftsmen the cost would probably prohibit its use.

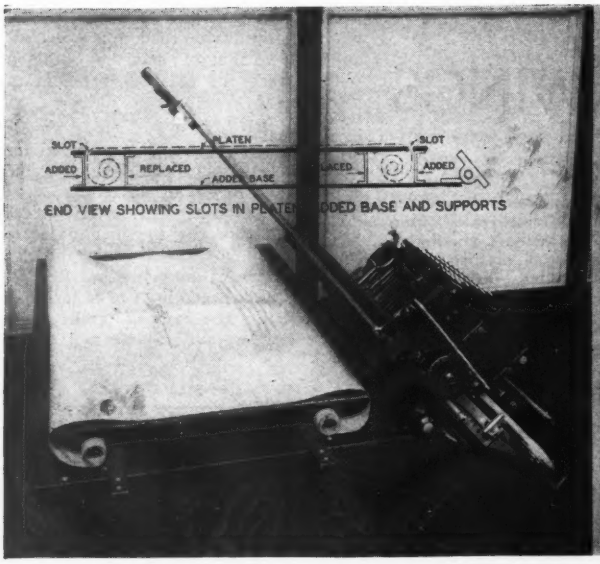


Fig. 3. Method of loading machine (new sub-base, slots in platen, and supports are visible)

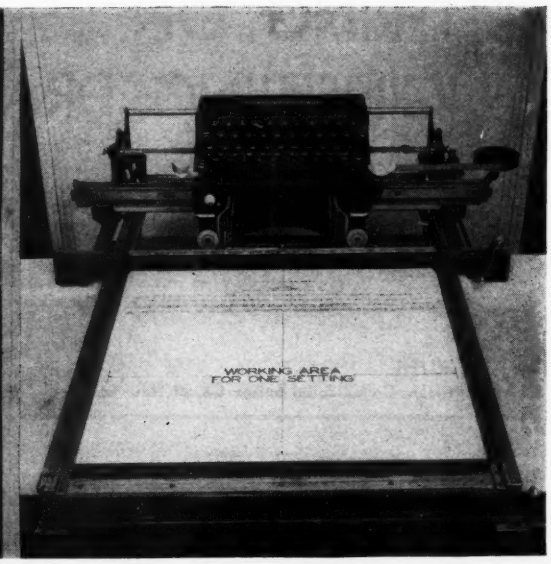


Fig. 4. Machine loaded, drawing clamped and ready for type. Working area, 18 in. by 16 in., for one setting is plainly visible

An economical means of obtaining a machine with the desired characteristics can be had by modifying an Underwood Elliott Fisher billing machine, as shown in Fig. 3. The platen was cut into three sections which were resupported from a sub-base by means of spacer feet. Cutting the platen into three sections formed two slots which allow the drawing to pass and be rolled in the space between the platen and the sub-base, as shown in Fig. 3. This arrangement will take any size drawing, both as to length and width, as shown in Fig. 4, and provides a composing area, visible in Fig. 4, of 18 in. vertically by 16 in. horizontally for one setting. The tracing may be slid lengthwise or rolled vertically for other settings.

Pica Gothic type is recommended because of its clear, sharp images and freedom from curlicues and tails. Other smaller or more elaborate types tend to clog up.

Care should be taken in the choice of a ribbon. The ribbon should not require carbon backing to obtain an opaque image. It should be quick-drying to prevent smudging, and be free from bleeding on the surface of the drawing, and leave no ghost marks after erasures are made.

It will be found that complete typing jobs on drawings are uneconomical from a time-saving viewpoint, and that it is more efficient to confine the machine work to titles, voluminous notes, bills of material, etc., leaving minor notes and dimensions to be lettered by the draftsman. Poor free-hand lettering may be corrected by the use of the new slot guide. This combination will result in drawings which have a much better chance of being considered acceptable.

Rewiring for Commercial and Industrial Buildings

PART I

To assist industrial establishments in adapting existing electrical systems to the increased loads imposed by war work, the Wiring Sales Committee of the Edison Electric Institute recently published a booklet* dealing with the use of the newly developed small diameter wires in the rewiring of buildings. By special permission from the Institute we are able to present here and in two succeeding articles much of the essential information contained in this booklet. As is indicated, the use of the new small diameter wires makes it possible to increase the capacity of old systems at comparatively small cost

A PROBLEM that confronts many industrial establishments today is that of adapting the existing electrical system to the increased loads imposed by war work. How to add vitally needed electrical capacity in existing buildings whose wiring is in conduit that is concealed in the walls, floors, ceilings and partitions of masonry or other types of construction and which cannot be increased in size without prohibitive expense of replacing existing raceways, installing the desired added wiring. How to eliminate low voltage due to overloaded wiring which prevents the proper operation of motors, or heating equipment in factories, or which prevents occupants of buildings or institutions from getting full benefit from lighting and other equipment installed.

There are, naturally, a number of ways of meeting these problems and the way in which they are met in any particular instance will depend upon the conditions surrounding each installation. There are, however, a number of general rules which can be easily applied and there are available a number of small diameter building wires which can be used in a variety of ways in modernizing old installations. The proper use of these small diameter building wires and the use of proved methods of re-circuiting offer good solutions in many cases:

The newly developed small building wires now available are particularly adapted for rewiring existing raceways and conduit systems for increased electrical capacity. These wires are listed in Table I.

The National Electrical Code makes frequent use of the term "raceway" which is defined as a channel for holding wires, cables, or bus-bars. The term includes rigid metal conduit, flexible metal conduit, electrical metallic tubing, underfloor raceways, cellular metal floor raceways, surface metal raceways, wireways, busways, and auxiliary gutters.

The two principal types of conduit

*Rewiring for Commercial and Industrial Buildings. Edison Electric Institute, 420 Lexington Ave., New York, N. Y. Price single copies 25 ct.

systems are rigid metal conduit and electrical metallic tubing. Rigid metallic conduit is made with a heavy wall thickness designed for threaded couplings, and is available with both galvanized and enamel-coated finishes. The trade sizes range from ½ to 6 in. diameter.

Electrical metallic tubing, also referred to as EMT, is lighter, being made with a thinner wall thickness designed for non-threaded coupling, and is available in galvanized finish. The trade sizes range from ½ to 2 in. diameter, and have the same inside diameters as rigid metal conduit of the corresponding size. The National Electrical Code provides that tubing shall not be used to contain conductors larger than No. 0.

Conduit Wiring

Conduit wiring systems are used for both exposed and concealed work. The principal reason for the use of conduit is to provide raceways through masonry and concealed spaces of buildings for the installation of electrical wiring. Other reasons for the use of conduit are to guard the wiring from mechanical injury when exposed to such conditions, and to provide an enclosed wiring system to exclude explosive vapor and dust mixtures where these conditions exist.

Conduit wiring has a useful and economical place as a wiring method, but it is not intended as a universal method, nor as the best method in all kinds of buildings. Conduit wiring should be used where it is the most economical method, or where it is required for special conditions.

It is a tribute to the usefulness and low cost of electricity that its use has grown far beyond the imagination of the most optimistic builders, architects, and engineers. Buildings erected only a few years ago now require several times as much electricity as the original conduit and wiring system was intended to supply. Heretofore, the heavy cost of replacing existing conduit with larger sizes, especially in masonry and concrete, has limited rewiring for increased electrical capacity.

Capacity May Be Increased

Since replacement of existing conduit is impractical, the only way in which the electrical capacity may be increased is by installing more wires or larger wires in the same conduits. And since the conduits usually contain all of the older type wires that are permitted, the new wires must be smaller in overall diameter for the same or even larger copper conductors. For example, Nos. 8 and 10 Small Diameter Wires have approximately the same overall diameter as No. 14 regular Type R wire.

A long series of improvements in the mechanical and electrical qualities of insulating materials and manufacturing methods have resulted in the small diameter building wires which have a thinner wall of insulation. Now, the modernization afforded by increased electrical capacity can be obtained by pulling the new wires into the existing conduits thus avoiding costly alterations in the building structure.

Small Diameter Wire Costs More—and Worth It

The current price of small diameter building wire is one and one-half to three times the price of the usual Code (Type R) wire. This fact has little if any bearing on a rewiring problem, because small diameter wire offers a solution to a problem heretofore beyond the limits of economic practicability.

For example, in one installation the total cost of rewiring and electrical modernization was $12,000, of which the wire amounted to $600. Lower cost Type R wire could have been purchased for $300, but the rewiring job would have cost about $48,000 because of the necessity of replacing conduits and redecorating the building.

Small diameter wires should be considered as a tool to open the way for electrical modernization of thousands of commercial and industrial buildings, large and small.

The partial tabulation shown in Table 2 illustrates the increased number and size of small diameter wires that may be installed in existing ½ and ¾-in. conduits.

Table II—Number* of Wires in Conduit

Size of Conduit	½-Inch Conduit			¾-Inch Conduit		
Size of Wire, Awg.	14	12	10	14	12	10
Code Wire, Types R, RP, RH & RW	4	3	1	7	5	4
Small Diameter, Types RPT & RHT	7	5	4	9	9	8
Small Diameter, Types RU & SN	9	8	6	9	9	9

*Nine wires are the maximum permitted in raceways, except in special cases of signal and control circuits.

Table I—Types of Building Wire

Type	Grade of Insulation	Max. Operating Temperature	Available Sizes, Awg.	Use*
		Thin-Wall Insulation		
RU	Latex Rubber	60 C (140 F)	14, 12, 10	Rewiring
SN	Synthetic	60 C (140 F)	14 to 4/0	Rewiring
RPT	Performance Rubber	60 C (140 F)	14, 12, 10	Rewiring
RHT	Heat Resistant Rubber	75 C (167 F)	14, 12, 10, 8	General or Rewiring
		Regular Insulation		
R	Code Rubber	50 C (122 F)	All	General or Rewiring
RW	Moisture Resistant Rubber	50 C (122 F)	All	General or Wet Locations
RP	Performance Rubber	60 C (140 F)	All	General or Rewiring
RH	Heat Resistant Rubber	75 C (167 F)	All	General or Rewiring

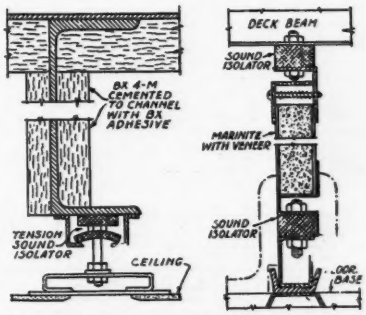
*General use means that the wire may be used in any usual situation for either new work or rewiring. For new work, the conduit fills given in Table 4, page 305 of the 1940 National Electrical Code must be used. For rewiring, the greater allowable conduit fills given in Tables 6 and 7, page 308 of the 1940 N. E. C. may be used.

Electrical inspectors having jurisdiction over wiring may be governed by municipal or state codes which supplement or differ from the National Electrical Code. Rewiring with small diameter wires is a comparatively new subject, and complete answers to all problems cannot yet be expected to be incorporated into all codes. In order to cope with just such conditions, the local inspection authority is usually empowered to grant special approval if required. When such situations arise it is usually a good plan to explain the problem and discuss its possible solution with the local electrical inspector.

Noiseless Construction

SINCE the development of acoustics as a distinct branch of engineering, much has been accomplished in soundproof construction. This is often desirable as in case of offices, laboratories, etc. Details of the construction used in dining salons, and public spaces on the S. S. America, has wide application elsewhere.

On certain portions of the ship it is necessary to isolate against air-borne noise from cargo handling on the deck above, prevent the transfer of the noise through structural members and the transmission of noise through panel partitions.



Method of stopping noise transmission by tension and compression isolators

Transmission of noise through the partitions is taken care of by using J-M Marinite, the other two were taken care of as shown by the sketch. J-M mineral felt dampening was applied to the deckhead and supporting channel as shown on the left. Ceiling panels were then suspended on tension isolators and the joiner bulkheads were rested on shapes from the deck member by compression isolators.

These isolators consist essentially of circular rubber blocks or shapes made up around steel studs and vulcanized. The two steel studs, one for securement to panel, the other to panel anchorage, are completely separated by a substantial thickness of rubber.

The Why, When, Where, What and How of FLOW METER INSTALLATION

Part III. How to Select the Primary Elements and the Most Desirable Differential, Permanent Pressure Loss and Orifices vs. Flow Nozzles[1]

By W. C. BENNETT
Cochrane Corp.

To MEASURE flow accurately, the primary or metering element must be so located in the piping layout that its operation follows well defined principles which have already been established by laboratory experimentation.

Certain minimum requirements for straight piping both preceding and following the element must be satisfied to avoid the effects of swirls, cross currents, and large eddies. Straightening vanes minimize these length requirements, but because of their somewhat doubtful value are only resorted to infrequently.

Two considerations affect the straight piping, namely, the character of the piping before the straight run and the diameter ratio of the primary element. The need for straight pipe increases (1) as the orifice opening becomes larger with respect to the inside diameter of the pipe and (2) as the piping preceding the straight run becomes more complicated.

Regarding this second consideration, certain of the more common types of installations have been studied as to their effect on metering accuracy and the result of these studies has been condensed into Fig. 2.

Regarding the first consideration, the orifice ratio, we must set up a quick method of its approximate determination, thereby also settling the differential range.

The family of curves in Fig. 3 is in effect a map of flow meter capacity

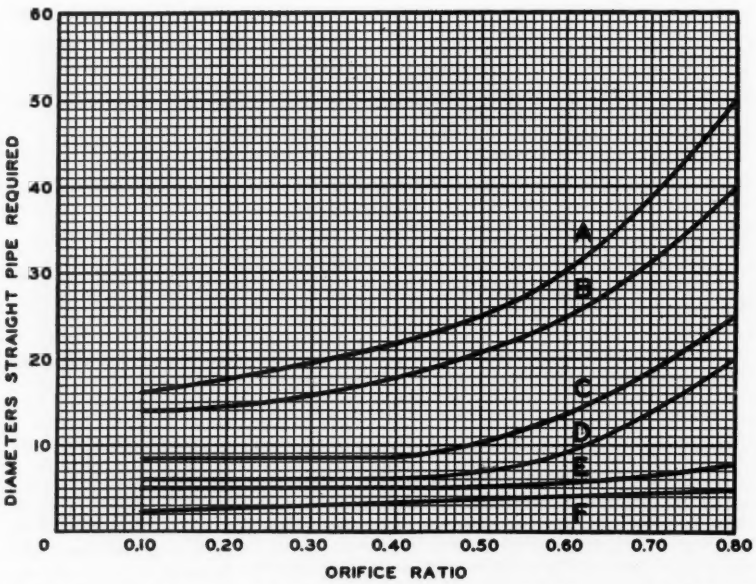


Fig. 2. Curves showing the run of straight pipe necessary preceding and following the orifice. This depends on the orifice ratio and the number and type of valves or elbows. For the upstream run use: Curve A after a globe or regulating valve; Curve B after two elbows not in the same plane; Curve C after two elbows in the same plane; Curve D after one elbow; and Curve E after straightening vanes. Use Curve F after the metering element itself, i.e., for the downstream run of pipe

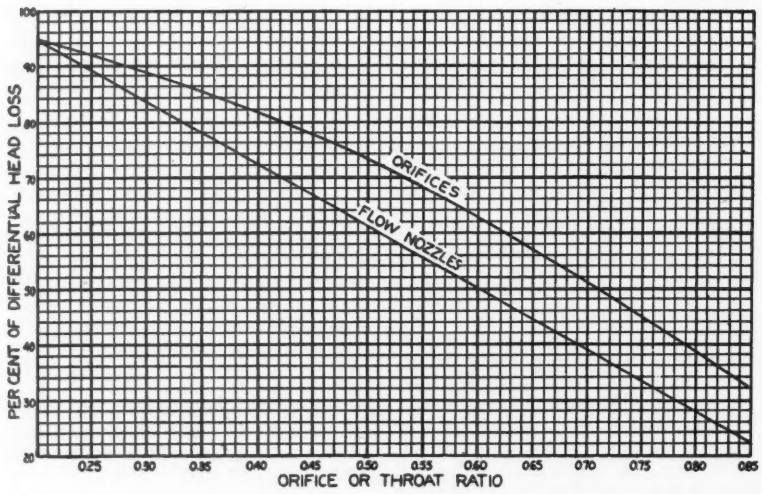


Fig. 1. Capacity curves for orifice plates showing the relation between orifice diameter ratios and the per cent of the maximum capacity as determined from Fig. 3

1Part I. Why, When and Where Flow Meters Are Needed, appeared on pp. 88 and 110 of the October issue; Part II, How Flow is Measured, appeared on p. 97 of the November issue. Part IV, Where to Install the Orifice or Flow Nozzle; and Part V, How to Pipe the Flow Meter, will appear in subsequent issues.

This series of articles considers only practical flow meter use and installation for those reasonably familiar with general theory and construction. For a complete development of the theory and a comprehensive treatment of fluid measurement the author refers interested readers to the publication of the A.S.M.E. Special Research Committee on Fluid Meters. These are available in three separate volumes: Part I on theory and application covers the classification of all types of fluid meters, develops the theory, gives physical constants and meter coefficients and includes an extensive bibliography. Part II describes the individual makes of meters (both primary and secondary devices) in commercial manufacture. Part III covers selection and installation. These are available from the American Society of Mechanical Engineers, 29 West 39th St., New York City, at the following prices: Part I, $3.00; Part II, $1.75; and Part III, $1.50.

for steam measurement and similar charts are available for other fluids. Each curve represents the maximum capacity for each differential pressure range, i.e., the capacity limit based on the largest permissible orifice ratio of 70 per cent.

The differential ranges are those available from one manufacturer, but since these curves are parallel, other meter ranges can be readily interpolated. Suppose for example we wish to measure 30,000 lb. per hr. of saturated steam at 500 psi in a 6-in. extra heavy pipe with a single elbow preceding the 5 ft. long meter run.

It will be observed that this can be accomplished by a meter with any of the following ranges: 117.75, 169.56, 230.79 or 301.44 in. differential. The meter with any of these ranges will show 30,000 as its highest graduation simply by providing the orifice plate with a smaller bore so as to produce a higher differential for the same 30,000 lb. per hr. flow rate.

What then would determine the selection of range in this case? Perhaps the length of straight pipe available is restricted. In that case a greater differential range will result in a smaller orifice ratio and reduce the straight pipe needed. Figures 1 and 3A and B enable one to arrive quickly at the approximate orifice ratio so as to apply the curves of Fig. 3 and determine the straight run demanded.

Thus in the example proceed as follows: Figures 3A and B tells that for differential range 117.75, the maximum

Data procedure for differential ranges

For a Differential Range of (In. of Water)	Maximum Capacity From Fig. 3 (Lb. per Hr.)	Per Cent of Max. Capacity	Orifice Ratio Fig. 1	Straight Piping In Diameters From Fig. 2 Upstream	Downstream
117.75	46,250	65	58	8.4	4.0
169.56	55,500	54.1	54	7.5	3.9
230.79	64,750	46.3	50	7.0	3.7
301.44	74,000	40.5	47	6.5	3.5

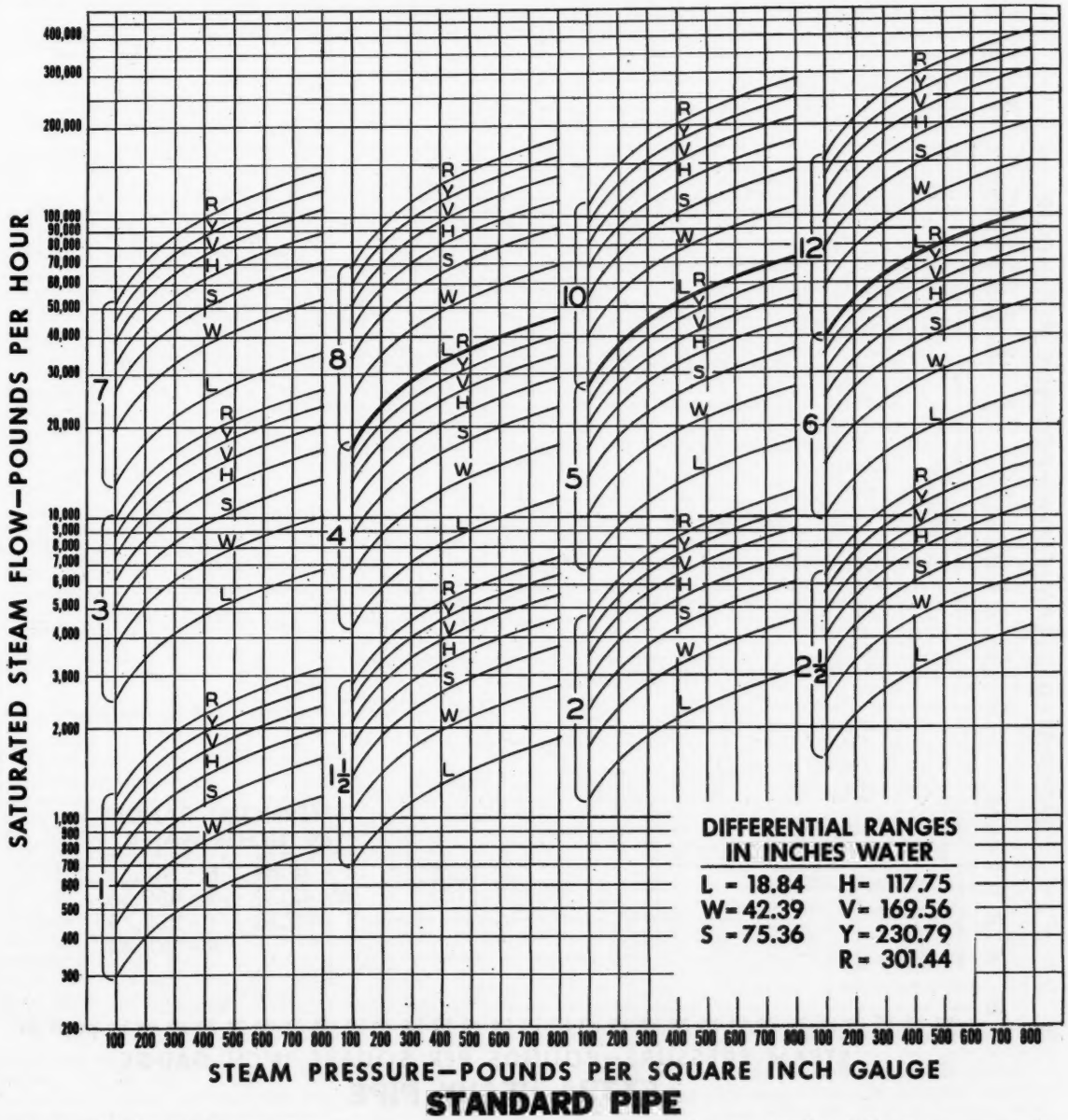


Fig. 3A. Chart showing the practical capacity ranges for metering steam in standard pipe, as a function of the steam pressure, pipe diameter and metering differential

capacity is 46,250 lb. per hr. The quantity to be measured is only 30,000 lb. per hr. which is 65 per cent of this capacity limit. From Fig. 1 the orifice ratio is seen to be 58 per cent and using this and Curve D (after one elbow) of Figs. 3A and B establish the need for 8.4 diam. of straight pipe upstream and 4 diam. downstream. By similar procedures, for other differential ranges the data tabulated in Table I can be determined.

In the example there were only 60 in. (5 ft.) or 10 diam. of straight pipe upstream. We are thus required to use the highest differential range (301.44) to get the smallest diameter ratio.

But, it may be objected, all this is based on using an orifice whereas by using a nozzle about 65 per cent greater capacity could be secured for each of these differential ranges. This is true and, if with an orifice the highest differential range is still insufficient, the flow nozzle will indeed be useful. It is, however, considerably more expensive than the orifice plate.

Permanent Pressure Loss

The permanent pressure loss sustained with various metering elements will now be discussed. Fortunately it rarely enters the problem because the static pressures are usually sufficiently elevated to make it of negligible value.

When flow exists through a pipe, the constriction introduced by an orifice plate, flow nozzle or Venturi tube sets up a temporary differential pressure which is measured by the flow meter. Although some of the temporary pressure drop is recovered after the fluid attains its normal velocity beyond the metering element, a certain amount is permanently lost.

In the case of orifice plates or flow nozzles, the permanent pressure loss decreases with an increase of orifice or throat ratio as shown by Fig. 4 for both orifice plates and flow nozzles. The loss sustained with an orifice plate is greater than that with a flow nozzle with the same throat ratio. However, if the two types of elements are designed to produce the same temporary differential pressure at a given flow rate, the resultant throat ratio of the nozzle will be so much smaller than

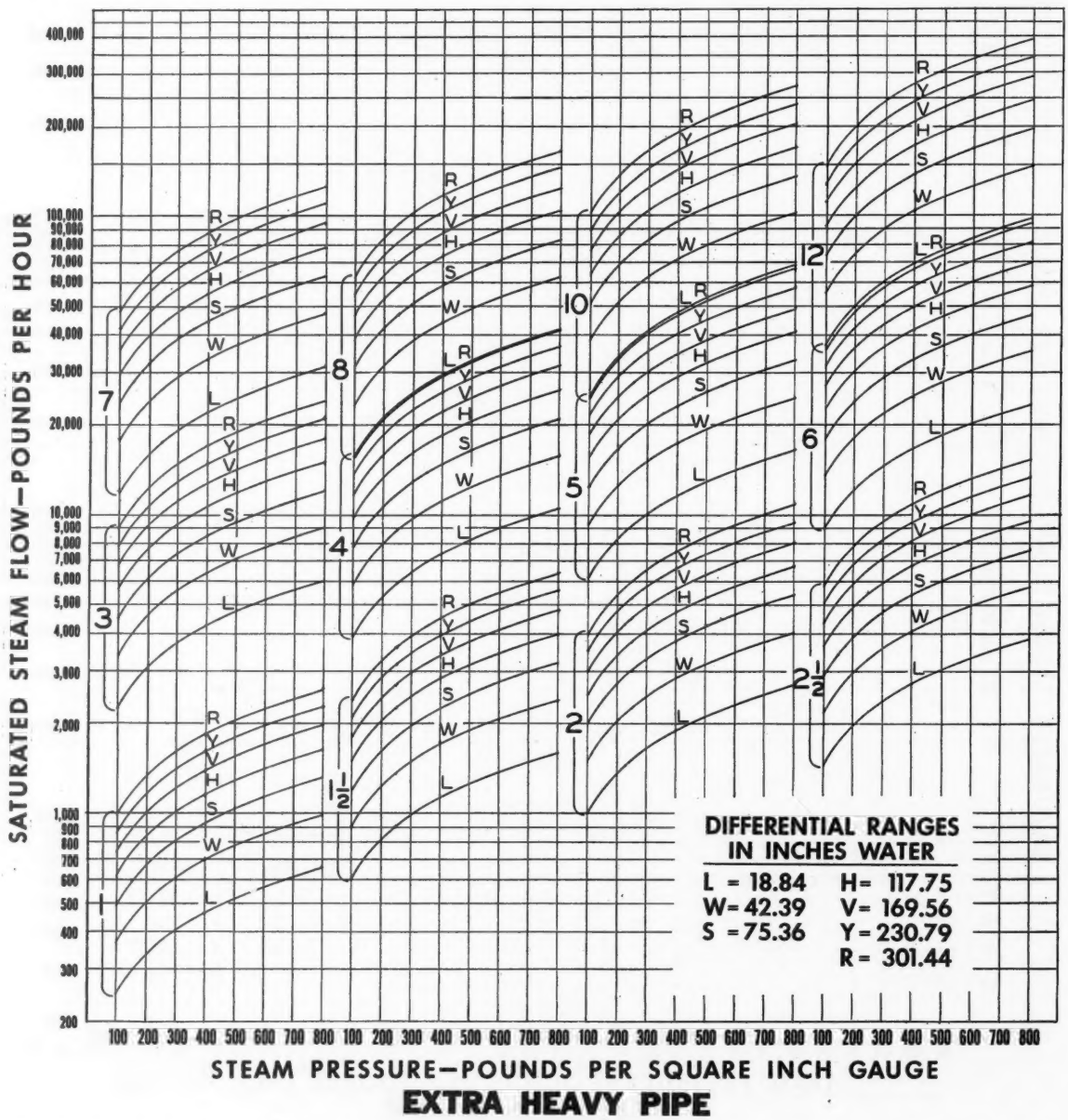


Fig. 3B. Chart showing the practical capacity ranges for metering steam in extra heavy pipe, as a function of the steam pressure, pipe diameter and metering differential

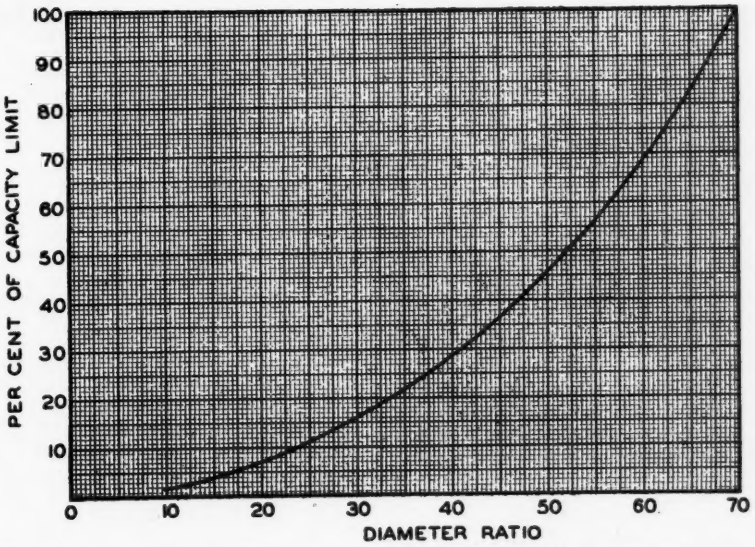


Fig. 4. Curves showing the permanent pressure loss as a percentage of the temporary metering differential for orifices and flow nozzles as a function of the diameter ratios

the orifice hole that the pressure loss sustained with the nozzle will equal or slightly exceed that of the orifice plate.

In determining the actual pressure loss with a given flow meter installation, account should be taken of the fact that the loss reduces rapidly with a reduction of scale reading on the meter. At partial capacities or scale readings $P = M\ (S/100)^2$. Where M equals the pressure loss at 100 per cent of the meter scale; S equals the percentage scale reading; and P is the pressure loss at a point on the scale corresponding to S.

Permanent pressure loss of a Venturi tube averages from 10 to 15 per cent of the temporary differential, dependent upon the type of tube employed. The so-called long type tube with a 5-deg. outlet cone produces about 10 per cent permanent pressure loss, while the short type with a 13-deg. outlet cone results in about 15 per cent permanent loss of the temporary differential.

The Inverted Bucket Trap

By N. T. PEF

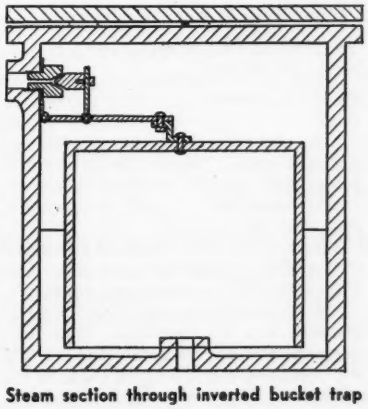
IN THE accompanying sketch is shown the conventional inverted bucket trap which is made by a number of manufacturers. The working principle is this: The space outside the bucket is filled with water of condensation while the inside of the bucket is filled with steam, the buoyancy of which keeps the bucket up and the discharge valve closed. When condensate fills the inside of the bucket it sinks, a certain amount of the condensate is discharged, and the steam again raises the bucket and closes the valve.

In order that this trap may work there must be condensation to keep the buoyancy of the bucket. Suppose there is no condensation, how can this trap work then? The fact of the matter is if this type of trap is installed at a point where it may not get a minimum amount of condensation at all times it will not work properly.

I have studied the action of these traps by means of a pressure gage in the discharge line. A small plant with a steam load of about 20,000 lb. per hr. has about 10 such traps installed, some ½ in. and some 1 in. size. When all ten traps are working right the pressure in the discharge line is 2 lb. If any of the traps are not getting enough condensation to keep the bucket buoyant it starts blowing steam and raises the pressure in the discharge line either 4 or 6 lb. depending upon whether the trap is the ½ in. or the 1 in. size.

All the traps are in perfect condition and have been checked. Normally 1 or 2 traps are blowing steam all the time and they are not always the same two. Sometimes 3 or 4 traps are blowing steam, but as a rule that does not last very long. And at rare short intervals they are all working right when the pressure in the discharge line drops to 2 lb., but normally the pressure is from 6 to 12 lb. and this represents a waste of about 500 lb. of steam per hr.

If this type of trap is used to drain steam lines, assurance should be made that there will be condensation at the point the trap is installed, because generally there is very little condensation from steam lines. For instance, taking the radiation loss at 100 B.t.u. per hr. per sq. ft. this means 1 lb. of steam per 10 sq. ft. of pipe so that an 8 in. pipe 100 ft. long will produce only 20 lb. condensation per hr. Since the capacity of such a line is about 10,000 lb. per hr. the condensation is only 0.2 per cent.



Steam section through inverted bucket trap

Part of this is in suspension carried as mist, so that the free condensation may be only 10 lb. per hr. Now, 10 lb. per hr. might be enough condensation to keep one inverted bucket trap working, but if there are 3 or 4 traps, some will not get any free condensation.

It might be argued that if such a trap is once filled with condensation it will always have it to keep the bucket buoyant. This would be true is the discharge valve were 100 per cent seal proof which of course cannot be obtained in practice.

Low Temperatures Affect Diesel Operation

ENGINES will digest so called low quality fuels with least difficulty under the conditions which result in high combustion chamber temperatures, W. S. Mount and G. A. Hope, Socony-Vacuum Oil Co., Inc., recently told the S. A. E. Conditions favoring high combustion temperatures are heavy loads, moderately high speed and heavy loads, high jacket water temperature and high air temperatures.

After an engine has been built and delivered to the customer, there is little he can do about the combustion process outside of maintaining the equipment in good condition. The one variable which is reasonably under his control is operating temperature and where possible the combustion chamber temperatures should be kept high. Low temperatures tend to reduce the certainty of ignition and a point may eventually be reached with some fuels where the engine misses badly or simply will not run.

Low temperatures accompanying light loads have made it necessary for engines to use higher cetane fuel than that normally supplied. If the temperatures and loads both fall, further increases in cetane number are required. Test data on a high speed automotive Diesel at ⅓ load, about 32 hp., shows that a drop in water jacket temperature from 165 to 130 deg. F. raised the cetane requirement from 50 to 54. The combustion efficiency does not appear to be impaired by the lower water temperatures since the exhaust remains equally clear at the hot and cold conditions. Thickening of the lubricating oil due to lower temperatures affects the fuel consumption and the output by reason of the greater friction losses which result.

* * *

Welding operators should exercise special care when they are working alone, when water or perspiration is present, when ventilation is restricted and when the location of their work is above ground or floor level.

Questions and Answers

Question No. 202

Should He Reduce the Speed of His Engine?

WE HAVE in our laundry plant an old steam engine, perhaps 50 yr. old. It is a 13-in. single slide valve engine with a 19-in. stroke and runs normally at 100 r.p.m. The boiler pressure used is 125 lb. ga. The cylinder is not equipped with cocks to permit the use of an indicator.

This engine operates against a back pressure of 5 lb., but ordinarily part of the exhaust blows to the atmosphere. If I assume a m.e.p. of 51½ lb. I calculate that this engine develops 65 hp. Is that approximately correct?

What can we do to use less steam? Is it possible to reduce the strokes to 68 r.p.m. so as to save steam? If so we will have to change the size of the pulley on the line shaft which now makes 250 r.p.m.

The engine drives 10 wash machines and 2 ironers. I will welcome suggestions from any reader as to how we can get this engine to use less steam.

Ithaca, N. Y. L. M. J. vL.

Question No. 203

This Engine Pulls Water Out of the Boiler

WE HAVE an old Unaflow engine direct connected to a 60-kw. alternator. I think the engine has a 16-in. bore and a 15 to 16-in. stroke and the speed is 257 r.p.m.

I am told that when this engine was tried out, it pulled water out of the boiler when the load was put on. The boiler here is rated at 100 hp.—a water-tube unit. Sometime ago I attempted to start this engine up, but was not very successful. It had terrific compression on the head end and practically none on the crank end; also, it would not take steam at the crank end. The cylinder has cylinder cocks and relief valves.

Can this engine be run non-condensing? Others around here feel that this engine is too large for the boiler, but we are now using a single-acting, 2-cylinder, Standard engine with a 75-kw. alternator hooked on to it. Since the Unaflow drives only a 60-kw. alternator it seems to me that the engine should be able to operate with the 100-hp. boiler, provided it is properly adjusted.

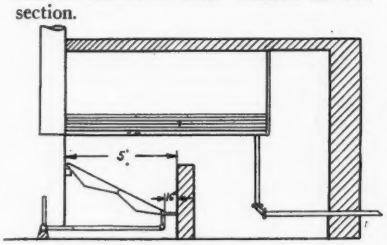
Can anybody advise me as to what the trouble might be and how I might overcome it? Will this engine have to have auxiliary exhaust valves to operate properly?

Elida, Ohio E. H.

Question No. 204

He Wants Advice on Firing His H.R.T. Boiler

I HAVE several questions that I would like to submit to other readers of this section.



Present grate arrangement

1. What would be considered the proper distance from the grates to the boiler shell in a 72 by 18 h.r.t. boiler, a, for hand firing and, b, for stoker firing?

2. How high should the bridge wall extend above the grates?

3. What should be the grate area for a boiler of this size?

4. Would changing from sloping grates with wide dump grate in the rear (used previously for coking process, but steam demand is now too great for this method of firing) to horizontal grates increase the steaming capacity?

Tiffin, Ohio CLOYD C. CAHILL

Question No. 205

How Much Condensing Water Is Needed Here?

How can I determine the amount of water to condense a certain amount of steam?

The generating unit here is a 500-kw. Allis-Chalmers turbine served by an Elliott 850 sq. ft. surface condenser. Steam conditions are, 170 lb. pressure, ga.; superheat 80 deg. F.

This turbine was installed sometime during 1918 and ran non-condensing until 1922, when the condenser was added.

Steam conditions then were 150 lb. pressure and no superheat. With this pressure and an electrical load of 475 kw. the steam consumption was 18 lb. per kw-hr. The total steam consumption, therefore, was 8550 lb. per hr., equivalent to a heat consumption of 8,575, 650 B.t.u. With these conditions, the temperature rise of the condensing water was 30 deg. The rise was from 52 to 82 deg. At this time the amount of condensing water used was 572 g.p.m.

In 1932 new boilers were installed which operated at 250 lb. pressure and a total steam temperature of 600 deg., but the pressure and temperature were reduced to 170 lb. and 420 deg. for operating the turbine.

At the present time our steam consumption is about 28 lb. per kw-hr. and our condensing water temperature rise is about 40 deg., running a vacuum of 18 to 20 in. I do not know how much condensing water we are using now.

The condenser manufacturer's guarantee on the condenser was as shown in the following tabulation, assuming a practically air-tight system and 500 gal. of circulating water per min. (250,000 lb. per hr.).

Inlet temp. cir. water	Lb. steam cond. per hr.	Vac. ref. to 30-in. bar.
55	8000	28.1
60	8000	27.7
55	6000	28.6
60	6000	28.4

Would an air leak be indicated if there is a difference of more than 6 or 8 deg. F. between the temperature of the steam entering the condenser and the condensate leaving the condenser?

Succasunna, N. J. F. J. S.

Question No. 206

Corrosion of Turbine Oil Reservoirs

I SHOULD like to have the advice or opinions of other turbine operators on a question that has given us considerable trouble. It involves the corrosion of the turbine oil reservoirs. Apparently this trouble is due to the accumulation of water in the oil system through steam leakage. We have tried various methods of reducing this leakage, but try as we may, water still seems to get in. There seems to be some corrosion in the oil piping, but most of it occurs in the oil reservoirs. Is there any way of treating the insides of the reservoirs so as to reduce the corrosion?

Somerville, N. J. J. T.

Question No. 207

What Is a Magnetic Variable Speed Drive?

YOU HAVE an article in your "Practical Engineer's Manual" about Magnetic Variable Speed Drives. I would like to secure more information regarding these drives. On what principle do they operate?

Seattle, Wash. J. B. M.

MAGNETIC variable speed drives are made in several ways, but the type that is coming into greater use in the stationary power field is the eddy-current type of coupling illustrated, diagrammatically, in the accompanying figure. At the time that the article in the "Practical Engineer's Manual" was written, these drives had been used to a considerable extent

HE'S BEEN ON THIS JOB FOR

Seven Years

Photographs taken in Nalco Laboratories, Chicago, Illinois

SOMETIMES we almost forget he is there. He is carrying out some research we are not ready to talk about yet, but it is bearing fruit. It is contributing constantly to one of the toughest known boiler feedwater treatment problems. It may even point the way to some changes in boilers themselves.

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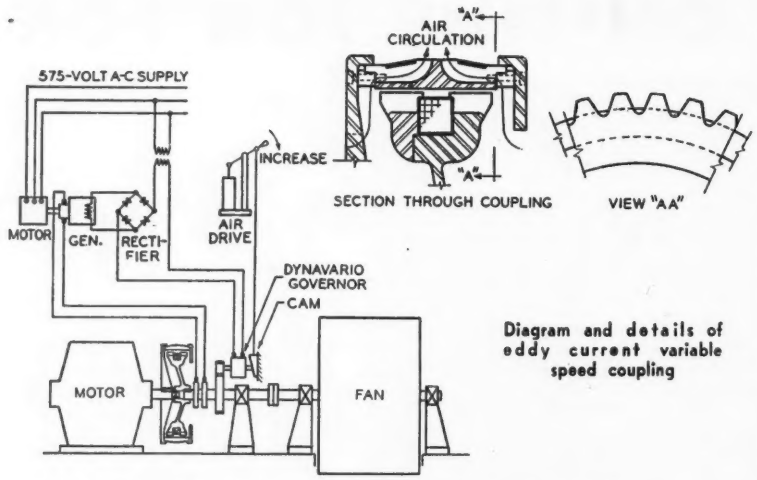

Diagram and details of eddy current variable speed coupling

for small marine drives but were then only beginning to be applied in the stationary power field.

At the present time they are being used widely for forced and induced draft fan drives in large central stations. The one depicted in the accompanying diagram is for the 1250-hp. induced draft fan drive at the new Oswego Station of the Niagara Hudson Power System.

As will be noted, it consists of two rotating elements, one inner element carrying an electrical winding between two toothed wheels and an outer member, drum shaped, surrounding the inner member. The winding of the inner element is connected to the external circuit through 2 collector rings and brushes. The outside element is fastened to the driving motor, the inner element to the driven machine.

The winding of the inner element is excited with direct current from a small motor-generator set, the field of which is supplied through a copper-oxide rectifier from the alternating current supply and controlled by a cam on the governor shaft.

With no excitation the outer element revolves at full motor speed while the inner element remains stationary. As excitation is applied to the winding of the inner element, however, a magnetic field is set up which sets up eddy currents in the magnetic structure of the outer element. The field due to these eddy currents reacting with the field of the inner element causes the inner element to revolve in proportion to the degree of excitation. Thus the speed of the driven machine can be varied between wide limits depending upon the amount of excitation supplied to the winding on the inner element.

As will be noted, in the case shown in the diagram, the cam on the governor shaft is controlled by the actuating mechanism of the combustion control system. Any movement of the governor cam results in a change in current through the rectifier and a consequent change in exciting current in the field of the motor generator.

The efficiency of this type of speed control compares favorably with that of other types of variable speed coupling devices, hydraulic or mechanical.

Question No. 208

Removing Sludge from Refrigerating System

WE HAVE been having trouble with the formation of sludge in our refrigeration system. What is the cause of this and how can it be removed?

Long Beach, Cal. F. McI.

Answer No. 170

The Fly Ash Problem

THIS QUESTION was asked by W. L. on page 122 of the May issue. He said he was in a tough spot and requested help in getting out of it. The problem consisted of eliminating fly ash from his boiler plant without the installation of expensive precipitators. They used spreader type stokers in combination with forced and induced draft and short stacks which could not be made higher. This answer by Joe Darnell should be of interest not only to W. L. but to many others facing the same problem as well.

Attention to the Coal or Fans May Help

THE FLY ASH problem presented by W. L. cannot be solved satisfactorily without additional information as to operating conditions and the plant layout.

For a small or even medium size plant a flue gas washer would be too expensive to install and too expensive to operate, and the corrosion problem would be serious. Such a washer is not recommended except for powdered coal burning installations, and then only where the dust problem is acute.

For spreader type stokers there should be less expensive means which will give good results, but definite recommendation cannot be made without further detailed information.

Starting with the coal, it is quite possible that it has too high a percentage of fines. A change in the coal purchasing specifications might overcome this difficulty.

Going next to the forced draft system it might be found that (a) the pressure is higher than necessary, (b) the distribution below the fuel bed is faulty, that is, there is tendency to blow through on one side or the other, or (c) there is a leakage of air along the sides or at the bridge wall causing undesirable eddy currents.

On the induced draft side of the system there may be restrictions in the boiler baffling, in the breeching, or even in the fan inlet, which cause unnecessarily high velocity of the flue gas. If the plant layout permits, the fan inlet box or boxes might be enlarged to form a plenum chamber which would cause an appreciable drop in the velocity of the gas and thereby permit deposition of the fly ash before reaching the fan.

If the induced draft fan is of the single inlet type without a conventional inlet box, and has merely an inlet elbow connected to the eye of the fan, then there is no question that the operation can be improved by installation of a well designed inlet box. Elimination of any and all restrictions in the system will reduce the total draft loss and thereby permit slowing down the velocity of the ash particles. This may permit the fan to be operated at slower speed if the motive power of the fan is such as to allow a reduction in speed. The draft varies as the square of the speed and the horsepower as the cube of the speed. For example, if the fan now operates at 4 in. static pressure at 700 r.p.m. and it is possible to reduce the draft requirements to 3.5 in., the fan can be operated at 655 r.p.m. at a little over 80 per cent of the power formerly required.

Naperville, Ill. J. R. DARNELL

Answer No. 185

Aha! Solved at Last! The Mystery of the Hunting Exciters

REMEMBER W.R.'s exciter problem on p. 100 of the July issue? He had three engine generator sets, 1850, 526, and 150-kv-a. respectively, operating in parallel. When he paralleled the large unit with one of the small ones, one of the two exciters installed would begin to hunt, sooner or later.

Sam Williams and Carl Egerter both suggested possible remedies in the September and October issues and below Mr. von Dannenberg discusses the problem. The comment by all three of these readers is pertinent and in other cases of a similar nature their suggestions might have led to the correct solution, but as explained in the final letter from William Robertson who asked the original question and who finally discovered what was wrong, the correct solution lay in quite a different direction.

This case merely proves the infinite variation in the causes of trouble in electro-mechanical equipment. It also proved the need for extreme caution and care in checking equipment for causes of trouble. Others less thorough might have overlooked the matter of clearance in the two exciters.

More Data Needed to Solve the Problem

THE QUESTION as given omits certain details. If it is an isolated plant, with

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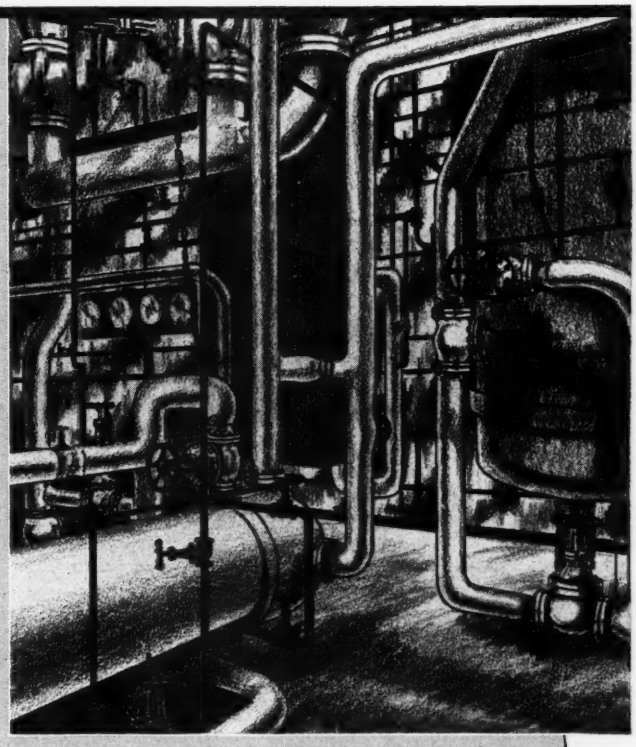

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no outside source of supply, then the exciters referred to must be direct connected to the main units with possibly at least one exciter unit engine driven.

It is not certain the way the details are given whether the hunting may not be between the main units, which are respectively 1850, 526 and 150 kv-a., and are sufficiently different in capacity so that with a continually fluctuating load or a load that may have marked periodic fluctuations, the governing system of one unit may make that unit, through too great sensitivity, take too much load causing it to slow down and begin a cycle of load readjustment during which "hunting" takes place in other units.

The foregoing is merely a supposition due to the way the question is outlined, but in any event the governing system of the units in question should be examined, tested and adjusted to operate under the best conditions for the load to be handled.

Whether this can be satisfactorily accomplished cannot be even guessed at, but problems of load division between units of materially different capacity seem in most instances to be settled for each condition through compromise adjustments to make the best of uncertain results.

In any event the description would indicate that the manufacturer of the driving element, engine or other prime mover should be called into the situation.

Further details or a rough diagram of the layout and electrical connections might be indicative of a suggested approach.

C. O. VON DANNENBERG

Brooklyn, N. Y.

This Is What Really Was Wrong

I WOULD like to explain the remedy we found for Question 185. A number of answers were received from readers suggesting various remedies, all of which had already been tried or checked but without effect.

These exciters are separately driven with power from the alternators at 230 v. One exciter is over 20 yr. old, while the other is new. During manual operation the load on each held fairly steady, but when the voltage regulator was put in operation, the hunting process started, first one and then the other trying to take all the load, being much worse as the load on the alternators became lighter.

After everything had been checked and rechecked and found to be in perfect order, the clearance on the two exciters was found to be a little different, that on the new exciter being less than the old one. Liners were removed from behind the poles on the new machine, and a little juggling done on the brush holders, and our trouble was over. We keep the voltage regulator on constantly now, and there is no sign of hunting at any load.

WILLIAM ROBERTSON, CH. ENGR.

Chicago, Ill. Wm. Wrigley Co.

Answer No. 189

Should the Heating System Be Drained?

WE ARE beginning to get the idea that a hot water system should not be drained during the non-heating season. J. O. R. asked this question on p. 93 of the August issue. Should the heating system be drained or left full of water during the non-heating season, and why?

A. J. Lubeley promptly responded in the September issue with a vigorous NO, in fact, definitely No. Mr. Lubeley was quite thorough in stating his reasons and they were technically sound. Since then, however, several other letters have come in and while some, like George Deichmann's snappy comeback for example, are not so lengthy, all of them without exception, say, very definitely NO.

It certainly is refreshing to have a question that most everybody is agreed on and it gives us renewed faith in the ability of the engineering mind to solve a problem if all the facts are presented correctly. The trouble with most questions asked is that they do not give enough data with which to work or they are too complex. This question by J. O. R. left no room for doubt; it asked simply, does it, or does it not? Quite obviously, it does not.

George Says No

MY ANSWER is No.

The hot water heating system should be left full of water because it will keep the packing in the valve stem from drying out, causing it to leak when starting up. It will keep the system from drying out, causing the scale to dry up, peel and crack and accumulate in the system. This would result in valve trouble when putting the system back in operation.

New Orleans, La. GEORGE DEICHMANN
Falstaff Brew Plant No. 4

Harold Says No

A HOT WATER heating system should not be drained during the non-heating season. The system should not be filled with fresh water before shutting down as fresh water contains too much air.

When water is heated the air and gases are driven off. This is the reason that there is less corrosion when the system is not drained.

If the system could be dried out and kept perfectly dry then it would be better to drain the system, but as it is almost impossible to dry out the system dry enough to prevent corrosion it is better to leave the water in and keep out the air.

Most corrosion of iron is caused by the iron and oxygen combining and moisture speeds up the process. As air is the best source of oxygen, air or moisture should be kept out and air is the easiest to keep out.

Lombard, Ill. HAROLD D. BROWN

Likewise, Mr. Graham

MY ANSWER would be no—and here is why.

1. Safety and freedom from damage. In a small house if the heating system is drained there is nothing to prevent the householder from using the boiler as an incinerator during the summer for burning rubbish. No empty boiler will withstand this treatment without cracking at least one of the more expensive sections and perhaps ruining the boiler. It has happened.

2. The cost of water to refill and the labor involved in refilling the system. This may not be so important in a small house having only 500 to 1000 sq. ft. of radiation, but it is important in systems of 30,000 sq. ft. which would hold up to 25,000 gal. of water. Of real importance is the fact that the water in the system has been heated and has discharged most, if not all, of its dissolved oxygen and other gases and is better water than could be put into it. Then too, the water may have been treated with certain rust inhibitive chemicals which would be lost if drained. This water has no more than the natural proportion of impurities plus any "dope" that has been added. Any loss by leakage carries away its proportionate quantity of impurities or inhibitive chemicals. There is no concentration of solids as occurs in the water being evaporated in a steam boiler.

3. The impossibility of completely draining the entire system. There are always a few pockets holding water which will interchange oxygen with the air and provide a condition for active corrosion at the water line. Any engineer who has inspected a spare boiler which has been kept filled to the water line has noted this condition to his sorrow. But you cannot easily get into a pipe system to make an inspection.

One of the recommendations for the installation of a hot water heating system is that the piping may be laid over uneven ground without regard to drainage from one end to the other. Consequently you find a lot of dips and rises in the main heating lines and most contractors are niggardly or neglectful of providing air vents and drain valves. The result is that many air pockets must be swept out of the circulating current of water or carried away by going into solution and released at some higher point having less pressure.

Automatic air vents usually located at the top of the system in each building give less trouble if the water level is kept high enough to keep these valves closed at all times. This will also prevent foreign matter from fouling the valve seats.

I have found that when any large section of the heating system has been drained for alterations it takes several weeks to get the air worked completely out of the piping and the system working as efficiently as before.

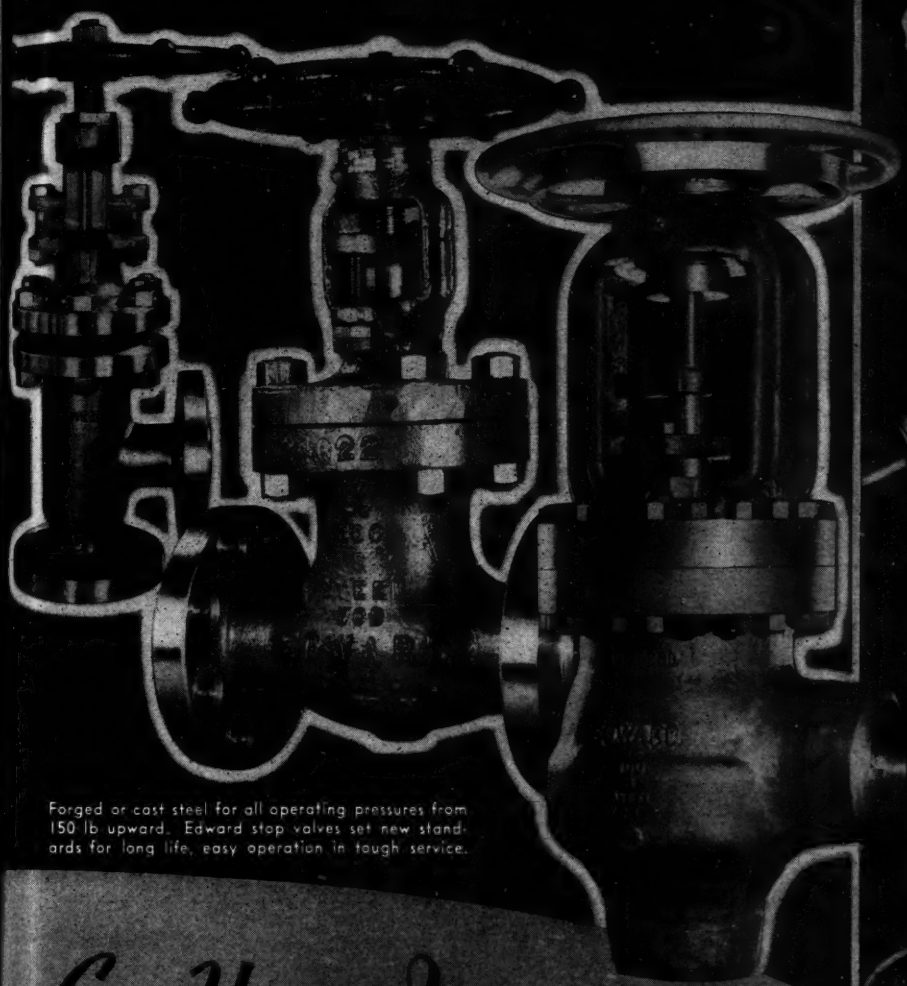
Asoinwall, Pa. JOHN A. GRAHAM

Martin Concurs in Part

HERE IS my answer to J. O. R.'s question, which may or may not be helpful. The reason I say this is that every person usually has some sort of a remote idea that his way is better, that is, in the care and management of heating boilers.

Manufacturers usually recommend their own suggestions as to the care of their type of equipment.

With a gravity system, the boiler should be cleaned each year by filling with



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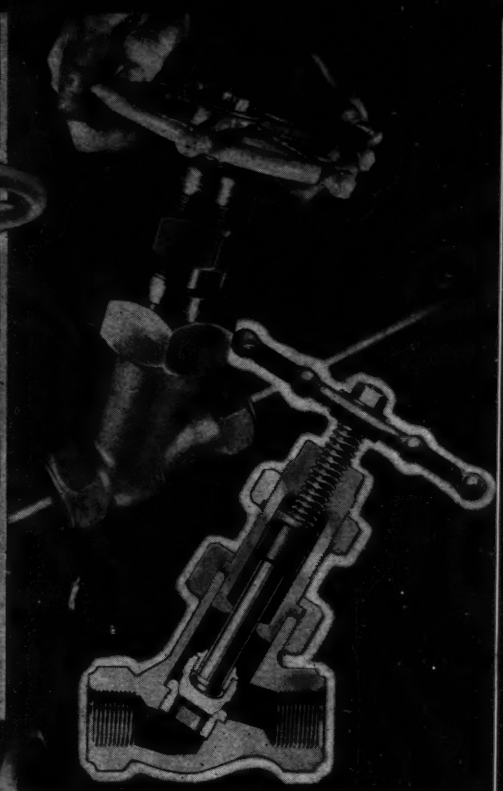

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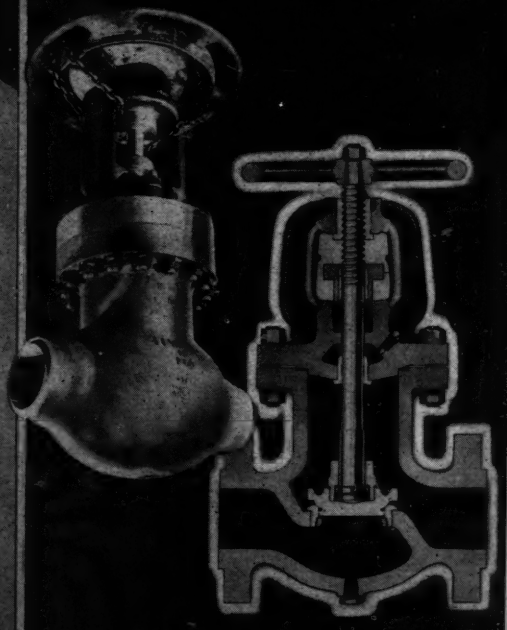

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pure water and emptying through the blow-off line. If the water is foul or dirty, it can be thoroughly cleaned by adding a few pounds of caustic soda, and allowing it to stand for a day, and then emptying and thoroughly rinsing.

During the summer months, when the heating boiler is shut down, it is best to drain the system, and air-valves and safety-valves be opened to permit the boiler to dry out and to remain so. Good results, however, are obtained by filling the boiler full of water, driving off the air slowly, and allowing the boiler to stay in this condition until it is put in use again in the fall of the year. The water should then be drained and a new supply again be added to the system before firing up.

Fairview, N. J. MARTIN N. GOZDENOVICH

Answer No. 192

Should He Throw the Economizer Away?

THIS LETTER by Mr. Kohlar, commenting on the question imposed by S.J. in the September issue should be of interest to others beside S.J. S.J. wanted to know whether the economizer in his plant could be removed entirely and what the effect of such removal would be on the operation of the boiler. The thing sounds simple enough, but as Mr. Kohlar points out there are a number of factors that should be given consideration before such a move is made. It all depends—

He Thinks It Will Pay to Retube

From S.J.'s query, I gather the impression that the initial operating difficulties experienced on this economizer have left kind of a bad taste even though these difficulties have been traced to poor feedwater and have been cleared up. If it had not been for this early trouble, there probably would be no doubt in S.J.'s mind as to the advisability of retubing. An old economizer cannot be discarded like an old hat; you do not merely toss it into the waste can. The holes left in the rear boiler drum will have to be closed up by rolling in blind nipples, and the labor involved in this operation will not be very much less than that involved in retubing the economizer. Inasmuch as the drums and fittings are still usable, it seems pitiful to eliminate the economizer just because of the tubes, which are the least expensive part of the unit. I am quite certain that it will pay to retube; and if the operators can increase the feedwater temperature 10 to 15 deg., no corrosion should be encountered, especially since the water treatment has been improved.

Since an economizer is a very efficient heat trap, the performance of the unit will deteriorate markedly upon its removal. Without detailed information as to the type of stoker, kind of coal, CO_2, etc., it is not possible to give exact answers to the effect on the unit performance; but it is quite in order to make a few rules of thumb estimates which will fairly indicate the direction of the changes that discarding the economizer would create. The stack temperature will probably increase from 450 deg. F. to 625 deg. F. This would increase the heat loss in the flue gas by about 4 per cent, and decrease the efficiency accordingly. There will probably be no difficulty in maintaining the present rating of 225 per cent, but because of the lower efficiency it will be necessary to burn more fuel. The increased heat input will cause an increase in the steam temperature, which I estimate would be in the neighborhood of 115 deg. F., instead of 100 deg. F. If the plant conditions are such that this increased superheat is undesirable, it will be necessary to remove some superheater surface.

The final paragraph of S.J.'s letter asks about the advisability of changing the baffling from parallel flow to cross flow. Generally speaking, cross flow is more effective than parallel flow; but in this case, the velocity of the gases across the tubes will be less than the velocity along the tubes, so that the net effect would be to maintain the same heat transfer in both cases. The draft loss would be lower with cross flow than with the parallel flow.

S.J., of course, knows his own plant far better than any outsider, so that it is obviously impossible to definitely advise him whether or not to discard his economizer, but I hope that these few remarks will be of value to him in making his decision.

Long Island City, N. Y. G. C. KOHLAR

Letters and Comments

The Moth and the Flame—High Wages

AN ANCIENT observing a cross-section of life in his day wrote, "There is an evil which I have seen and it is common among men"; it seems to hold just as good today as in that far off time; that is the condition of unrest among working people.

When I went home over the week end my son, who is a roll turner, said to me, "Dad, I am going to get me a job where I can make money like other fellows." I said, "Son, let us reason this thing over before you come to a final decision."

The first thing to consider is the slight difference in the hourly rate, but the reason such large monthly checks can be built up is because they work seven days or more a week and get time and a half and double time for overtime. But remember no one can continue to work so continuously without injuring his health and it is questionable whether the chances taken are worth the extra money. The second thing is he must start as a new employe, thus losing all his seniority advantages which he holds with the old company.

Third, he must go into a strange place among people who never knew him and care less, eat in some quick and dirty joint, live in a cheap rooming house where everyone uses his socks and shirts, or take the family along and probably live in a crowded slum district. I have run into several such cases recently. I had occasion to stop at a very large old fashioned mansion. A young man came to the door with tears in his eyes. He said he had been induced to leave a good steady job in a fine small town where he had a nice little home with garden and all to come to the large city at twice the wages. Shortly after the Government had decided their product was non-essential. He was down to two days a week with the possibility of being laid off at any time.

To make matters worse, he had agreed to rent this large ten room house for a year expecting to furnish it with his four rooms of furniture and rent the rooms. As a result half the house was unfurnished and he could not rent any of it. His wife and children were down sick and the landlord has just given notice he would hold his furniture for the year's rent. So the family was completely deflated among strangers with no one to help. This is typical of several cases I have found lately.

I would, therefore, advise all who have a fairly dependable job to stay put for the duration at least.

Johnstown, Pa. H. S. BRACKEN.

Rearrangement of Piping Solves Corrosion Trouble

A LARGE industrial plant operating three 72 by 18 h.r.t. boilers was having trouble with pitting of boiler tubes as well as boiler shell. The trouble began about 3 mo. after the installation of a vacuum heating and drying system in the plant and they were at a loss to know what was causing the trouble. In looking

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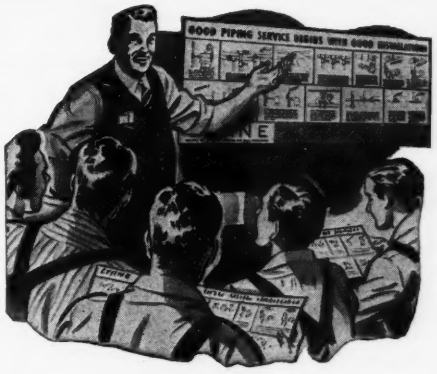

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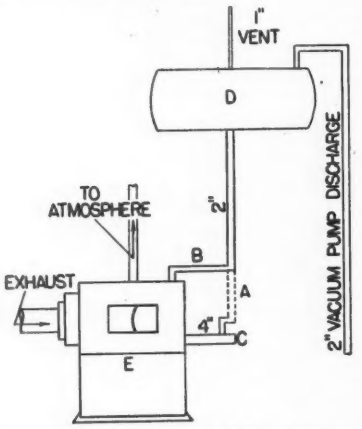
City ..... *State* .....

over the piping arrangement I noticed that the discharge from a steam-driven vacuum pump was delivered to a "break-up" tank, D, on the boiler house wall about 15 ft. above floor level and was vented to the atmosphere by ½-in. pipe. The return was then run to a point C in the open feedwater heater, which opening was about 3 in. above water lines in the heater. The dotted line A shows how the return line was run.



By changing the entrance of the return line from point A to B, corrosion was eliminated

Thinking that maybe the break-up tank was acting more as a receiver than a break-up tank I tapped a 2-in. pipe opening into the top of the heater and arranged the piping as at B so that returns would flow over the break-up plates in heater along with make-up water and, thus, provide better liberation of the oxygen present in the vacuum returns. After making this change in the vacuum return the pitting in the boiler stopped and to date no more trouble has been encountered.

Seymour, Ind. WM. HEIDWIG

Importance of Fuel Conservation

AS THE War moves into more and more serious phases, the matter of conserving fuel becomes of increasing importance. Not only does this involve the saving of coal as such, but the saving of car miles in transporting it from mine to consumer, the saving of manpower in producing it, the saving of rubber and gasoline in distributing it and above all the avoidance of interruption to production in the factories of the nation.

For I interpret the word "conservation" as including all these and many more. The wastage of coal in millions of homes due to antiquated and worn-out furnaces, lack of storm sash, weather stripping and insulation, is appalling. The conversion of thousands of gas and oil burning furnaces to coal fuel will throw the burden of firing upon as many thousands of people utterly unfamiliar with the use of coal. The calling to the colors of thousands of engineers and firemen will put into the boiler rooms of the nation a great number of men inexperienced in the operation of boilers and stokers. The education of these men therefore becomes an important item in the conservation program.

The very magnitude of the need calls for correction as wide-spread, as detailed and as basic as the trouble itself. No local or optional treatment will do any good. It is a National problem and must be treated nationally.

Only the government has the authority, the prestige and the interest to manage this thing adequately. A department of the Fuel Administration should be organized with one directing head and an adequate staff to cover the entire coal-burning area of the United States.

The tangible savings that could be made would amply repay the cost. The coal savings in both home and factory would secure the whole-hearted support of every user. The greater satisfaction in the use of coal as a fuel would enhance the value of this commodity in the eyes of the public. *This is the coal-man's opportunity.*

No greater service to the nation could be given by a great magazine than helping to promote this essential project. I hope this will appeal to you as it does to me.

Chicago, Ill. JOSEPH HARRINGTON

A "Punk" Boiler Operator Expresses Himself

Editor's Note. What a person does to make a livelihood has nothing to do with his native intelligence. Mr. Hill, who writes this pertinent letter may be, as he styles himself, just a "punk boiler operator," but this "slant" on this particular question shows that he has both feet on the ground. We quite agree with him. Judging the project merely from an operational point of view the Santee-Cooper Clearing project was undoubtedly a remarkable job, but from the standpoint of conservation it represents our economic system at its worst. Merely because nobody could make a profit on it, a great quantity of timber was ruthlessly destroyed. Mr. Hill's dilemma is understandable. On the one hand he, as a boiler operator is urged to save every last B.t.u. in the fuel, while on the other hand countless millions of B.t.u.'s are deliberately thrown away in submerging a whole forest. Of course, questions of handling, transportation, selling and distribution entered into the economics of the situation, but the fact remains that a vast quantity of wood was wasted. Mr. Hill asks to be "set right on this". We do not know the answer; perhaps someone else does.

I AM just a punk boiler operator who reads the monthly issues of POWER PLANT ENGINEERING and I am much vexed at your article on the Santee-Cooper project.

We are taught that this country's fuel supply is fast diminishing and that we must save every B.t.u. available. We are also told that our forests are going and efforts to maintain them are being carried out. We are also told that a large per cent of our wood pulp for paper is being imported from Canada. Yet we see by the photographs in your magazine where thousands of logs are cut, trimmed and wired to the stumps until they become water-logged and will not float. I note that some 103,000 acres were cleared and wonder in the face of diminishing fuel supply and wood pulp supply why this wood was not saved. I realize that swamp conditions and transportation probably enter into the matter, but it is hard to explain to a new operator why B.t.u.'s and fuel should be conserved, when such destruction of wood is allowed with no effort to save it.

The new operator will probably say, "Why should I sweat to save a few B.t.u.'s while others are destroying them by the millions." Please set me right on this.

Pekin, Ill. VANCIL F. HILL

Our Units Are Not Nuts

I READ with much interest C. O. Sandstrom's comment on page 104 of the September issue regarding my "brash prediction", as he calls it, regarding the adoption of the metric system by the United States.

It was not my intention to start a controversy, nor is it now, because I have before me a statement by our National Bureau of Standards in which that bureau says, "It is generally agreed by those favoring adoption of the metric system in this country and by those who oppose it that this is not a proper time to devote any appreciable time or energy to arguing the merits of this question or carrying on extensive propaganda in favor of either side of the question."

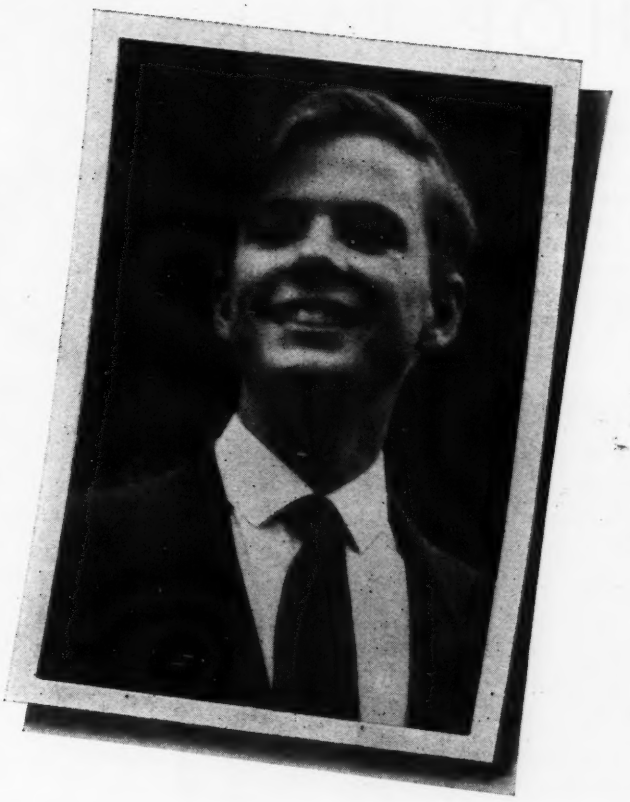
The Bureau of Standards is neutral. It says, "Those desiring arguments in favor of its compulsory adoption are referred to the Metric Association, Pottsville, Pa. Those desiring arguments against it are referred to the American Institute of Weights and Measures, 33 Rector St., New York City." This writer therefore suggests that the matter be allowed to rest there for the duration. After the war is over the question will doubtless come up again. It is an important question.

One thing that Mr. Sandstrom says, however, should be straightened out. He says regarding the metric system, "Its use in the so-called metric countries is by compulsion—bureaucratic coercion."

Just how true that statement is, I do not know, but it appears that we have bureaucratic compulsion in the United States also in view of the following which I am copying from the Bureau of Standards Letter Circular LC 681: "Its use (the metric system) has not been made obligatory except in a few special cases." In other words we have advanced far enough so that the metric system is used by compulsion in "a few special cases".

Newark, N. J. W. F. SCHAPHORST

Son...



HE has just turned eighteen. Shaves twice a week and maybe a hair or two is sprouting on his chest. He shies away now when his dad tries to be affectionate and we noticed some lipstick on one of his handkerchiefs after a country-club junior dance not so long ago. But it seems only yesterday, perhaps it was the day before, that he was a chubby legged kid swinging from the arch of the doorway, leading to the dining room, in a gadget that was something like a breeches buoy and he was sucking at the end of a turkey bone.

He went back to school this Fall, a tall, athletic lad, budding into manhood, but there was something else on his mind beside the football and hockey teams or the little blonde girl with whom he had "palled" around during the Summer. It seems as though he was listening for a certain call—the Clarion call that poets sing about—and, perhaps we just imagined it, but we thought we saw an upward jutting of his chin, a certain light in his eyes, and a sort of a rearing-to-go expression in his face.

It chilled us a bit in the region of our heart, when we thought of his discarding the sports coat for the "O.D." of the Army or the blue of the Navy. There was a bit of a catch in our throat as we thought of his putting aside his football helmet for one of steel; of his hanging up his hockey stick and reaching for a gun. After all we still regard him as just a little boy.

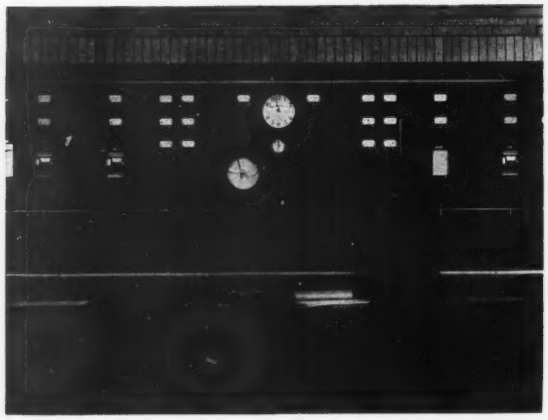
They tell us that the eighteen and nineteen year old lads are to be called to the service. When that day comes to us there will be prayers, but no tears. We shall not mourn nor shall we be fearful. Rather there will come welling up from our hearts that warm feeling of pride that millions of other parents will sense when their beloved lads marched away. Our lad is no different than the others. We are no different than other loving parents, nor is our sacrifice any greater. They are going to make great soldiers, sailors, marines and fliers out of these youngsters. And they will become a mighty force when they take their places beside their brothers in arms. They too know what they fight for. They too know full well of the sacrifices that must be made before the evil powers that threaten the world can be overcome.

And let us not forget that they are counting on us. They know that we shall not fail them.

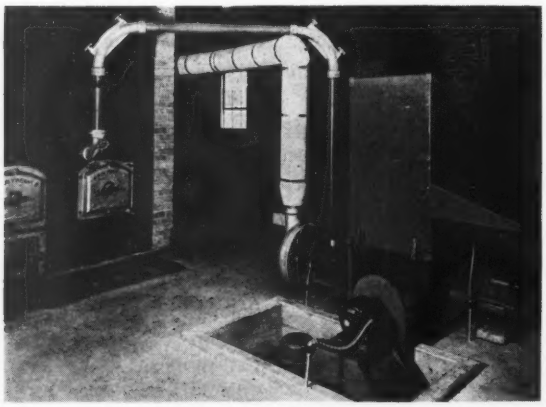
God be with them and their brothers.

SHOP TALK

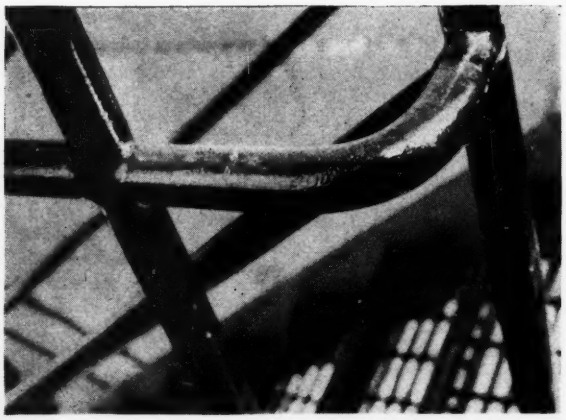
A department showing by means of photographs how engineers in various plants have overcome certain obstacles or devised methods to facilitate operation. If you have done something along similar lines that you are proud of or which you feel may be of interest to others, send us a picture and a paragraph of explanation. If the photograph is good and if the idea is original we will present it on this page and pay you for it



ILLUMINATED PIPING DIAGRAM. The 80,000,000-gal. water system for the City of Toledo, O., is safeguarded by an illuminated piping diagram, the first of its kind, on the Westinghouse benchboard. It depicts the actual path of the water through the system and shows the position of the valves. Three 1100-hp. and one 700-hp. 2300-v wound rotor induction motors drive four centrifugal pumping units, each with a capacity of 55 million gal. per day. These units pump Lake Erie water, after it passes through water screens, into the filter plant, through 9 mi. of 78-in. steel pipe line. The water is conveyed to the pumping station through approximately 3 mi. of 108-in. concrete conduit from a crib which is located about 2¼ mi. from shore.



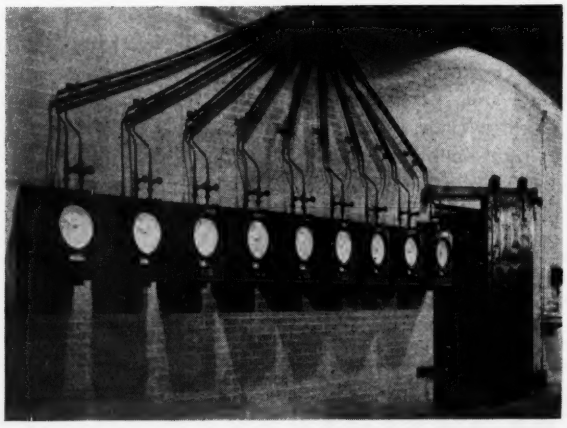
STOKER INSTALLATION. The United States Standard Products Co., has an interesting installation of a pneumatic spreader type stoker in its plant at Woodworth, Wis. To allow ample space for the future installation of an additional boiler, the stoker and the undergrate fan unit were placed well over to one side of the present boiler.



WELDED RAILINGS. This is a good example of the use of welding in fabricating a stairway railing in a power plant. In years past, a railing of this kind would have been made up of a large number of elbows and tees and the finished job would not have had the smooth streamlined appearance that this all welded job has. This is one of the railings at the power plant of the Atlantic Gelatin Co., Woburn, Mass.

FLAME FAILURE CONTROL. This is an interesting installation in a far western power plant of an electric eye (photocell) installed in the top of a furnace for the purpose of cutting off the fuel supply (coal or oil) in case of loss of ignition. The photocell is so arranged that it is exposed to the light of the flame. As long as the flame holds, light continues to excite this photocell and nothing happens, but the instant the flame fails the photocell acts, through a system of relays, to cut off the supply of fuel.

METER PIPING. Where a number of flow meters are installed in a place where the piping cannot be easily concealed it is often possible to do a nice job by fanning the lines out in this fashion. This is an installation in the basement power plant of the New York Life Insurance Co. building in New York. This not only provides an installation that is pleasing in appearance but also provides easy access to the piping.



The Ideal "TOP KICK"

Many an industrial commander, in these critical times, notes with keen satisfaction the smooth, well drilled performance of his steam power plant—and gives deserved credit to his "top sergeant": A Hays Combustion Control System.

Here, indeed is a seasoned, capable veteran, skilled at getting utmost efficiency out of the equipment he commands.

Automatically, "The All-Electric Way" Hays system controls combustion. It's made to do that. It regulates all combustion elements—measures each variation and corrects instantly—measures the correction: *maintains the right balance.*

With the nation's war effort putting extra demands on present steam power equipment, Hays Combustion Control Systems are doing an extraordinary job—stretching steam capacity, *safely;* getting the utmost out of existing boiler room equipment, *safely;* saving man-hours, saving operating costs.

To enlist this veteran in your own service, send for the Hays Combustion Control Catalog—it is full of pertinent steam-power data.

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REGULAR INSPECTION WILL REDUCE REPAIR TIME

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WESTINGHOUSE ELECTRIC & MAINTENANCE CO.

MOTORS

✔ *Keep the Windings, Ventilating Ducts, Commutators and Brush Rigging Clean*

In dusty locations, blow out weekly; under severe conditions, daily. Do not use air pressure higher than 50 lbs.

✔ *Lubricate Regularly, Carefully*

Follow manufacturer's instructions. Oil *daily* those motors that require it. Schedule definite oiling dates for the others. In dusty or damp locations, drain oil once a month and renew. Do not over-lubricate. It wastes oil, gets in windings and deteriorates insulation.

✔ *Examine Bearings*

Check daily on heavily used motors; once a week on others. Check oil ring. Feel for high temperatures. Check for excessive end play.

✔ *Check Air Gap between the Rotor and the Stator*

Check weekly on motors that operate with excessive belt tension; others, once a month. Differences in width of gap indicate bearing wear which, once started, accelerates rapidly.

✔ *Inspect Brushes and Commutators*

Check daily on those motors in severe service; others once a week. Keep commutators smooth, with brushes seated perfectly. On carbon brushes use correct grade to prevent excessive commutator wear and control arcing.

✔ *Inspect All Exposed Motor Leads*

Check weekly. Keep connections tight, free from oil and moisture, well insulated and protected.

✔ *Inspect Ground Connections*

Check weekly. Keep tight and in good condition. THESE ARE IMPORTANT TO SAFETY of employes and, in some cases, of current protective devices.

WIRING

✔ *Keep Wiring in Safe Condition*

Examine monthly where vibration exists. Keep lock nuts and bushings tight on conduit, cables and other raceways. Protect wire from oil and water. Keep open wiring tight, insulated and safe from mechanical injury. Inspect all wiring once a year.

✔ *Check Extensions and Drop Cords*

Examine every three months where use is heavy. Check closely where wire enters socket, plug, switch, etc. Replace or repair excess wear promptly. Keep drop cords away from nails, metal hooks, etc. Keep lamp guards in place.

✔ *Keep Switch, Junction, Fuse and Panel Boxes Clean and Tightly Covered*

In dusty locations clean out weekly. Keep covers and unused "knockout" plugs in place. Inspect monthly.

FUSES

✔ *Check Size*

Twice a year inspect all fuses to determine that circuits are not overfused.

✔ *Keep Fuse Clips Clean and Tight*

Check connections to prevent overheating and breakdown.

✔ *Maintain Refillable Type Fuses*

Replace charred casings. Keep fuse assembly tight. Refill with links at the same rating as the casing.

✔ *Keep Fuse and Switch Cabinets Tight*

Prevent escaping sparks when fuses blow by plugging unused knockouts. Always keep doors tightly closed and secured.

TRANSFORMERS

✔ *Keep Oil in Good Condition*

Test annually to determine dielectric strength. If less than 18 kilovolts in standard tester, recondition oil.

✔ *Maintain Oil at Proper Level*

Check oil level every three months. Replace leakage and evaporation loss promptly.

✔ *Prevent Excessive Temperatures*

Test operating temperature of fully loaded transformer once a month. Temperature should never exceed 90°C.

CONTROL EQUIPMENT

Includes Magnetic Switches, Air And Oil Circuit Breakers, Controllers, Compensators, etc.

✔ *Keep Control Equipment Clean*

Once a week, clean and blow out dirt and dust from starting switches, compensators and air circuit breakers. Under unusually clean conditions, clean out quarterly or semiannually. Keep dirt and dust off high voltage bushings and terminals.

✔ *Keep Contacts Smooth*

Inspect heavily used equipment weekly; others once a month. File burned contacts smooth or replace. DO NOT LUBRICATE CONTACT SURFACES.

✔ *Replace Worn Parts*

Under severe conditions examine all equipment monthly and replace all worn or burned parts; under normal conditions, semiannually. Keep adjustments correct.

✔ *Keep Electrical and Mechanical Connections Tight*

Once a week inspect parts that vibrate. Look for loose connections, missing or loose nuts, and broken mechanical parts.

✔ *Keep Oil at Proper Level and in Good Condition*

Under severe conditions or in dirty or damp locations, make a monthly check of oil condition and oil level. Replace dirty or gummy oil. Keep level up to indicator.

✔ *Check Overload Devices*

Circuit breaker tripping points should be checked monthly. Replace dashpot oil if thick and gummy. Keep orifices in plunger clear. Keep leather bellows soft and pliable with neat's-foot oil. Be sure that heater coils for thermal overload relays are the correct size. Check overload relay settings every six months.

LIGHTNING ARRESTERS

✔ *Maintain Ground Connections*

Inspect in early spring before the start of the lightning season. Check the condition and resistance of ground connections. Resistance should not be over 5 ohms. A buried water main provides good ground. NEVER RUN GROUND WIRE THROUGH IRON OR STEEL PIPE UNLESS WIRE AND PIPE ARE BOUND TOGETHER.

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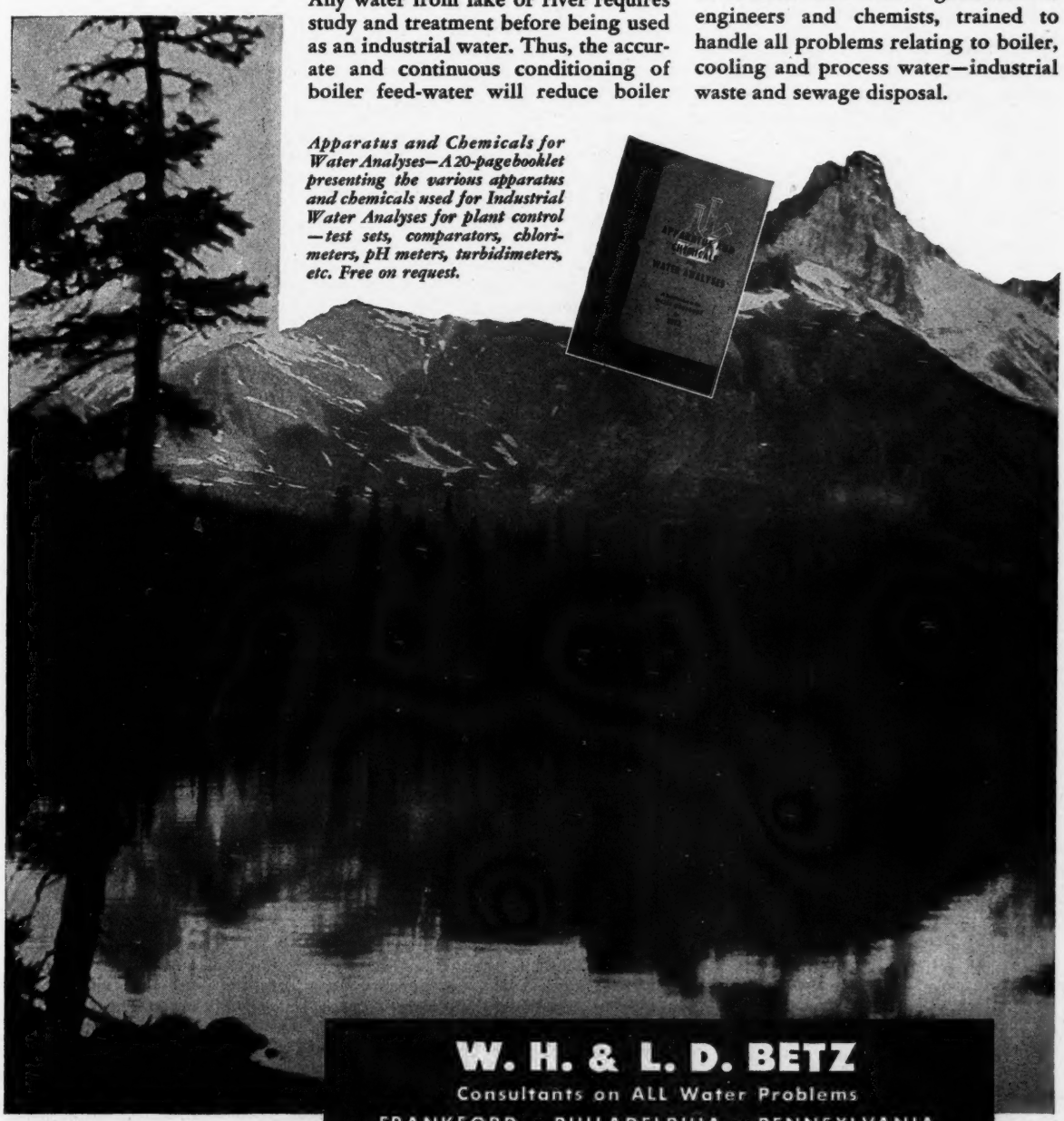
but Unfit for Industrial Use!

Water, clear and sparkling from a mountain lake, may be perfectly potable in its natural state, yet without chemical treatment will be altogether unsuitable for boiler feed. Water demands of industry are sometimes more exacting than those of the human system.

Any water from lake or river requires study and treatment before being used as an industrial water. Thus, the accurate and continuous conditioning of boiler feed-water will reduce boiler outages caused by scale, corrosion and carryover . . . outages requiring costly repairs and resulting in loss of production.

Boiler outages can be prevented through the supervisory services of W. H. & L. D. Betz. Here is an organization of engineers and chemists, trained to handle all problems relating to boiler, cooling and process water—industrial waste and sewage disposal.

Apparatus and Chemicals for Water Analyses—A 20-page booklet presenting the various apparatus and chemicals used for Industrial Water Analyses for plant control —test sets, comparators, chlorimeters, pH meters, turbidimeters, etc. Free on request.



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Consultants on ALL Water Problems

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Third Annual Water Conference

Modern methods of dealing with industrial waters discussed at meeting sponsored by Engineers' Society of Western Pennsylvania revealed new theories regarding salts in steam and prevention of caustic embrittlement of steam boiler metals

BY BRINGING together for the third time some two hundred water treatment specialists, manufacturers of water treating equipment and engineers confronted with water problems in their own plants, the Engineers' Society of Western Pennsylvania has demonstrated that this branch of engineering is expanding rapidly to meet the changes that are taking place in the various industries. In the power field, cycle and pressure changes brought on conditions demanding changes in water treatment methods. Slime and algae growth in circulating water systems cut down efficiencies in operation and are demanding special studies by specialists.

It is recognized that many of the problems met by industry due to the character of the water used are not yet solved to complete satisfaction, so this conference, as well as those in the past, has contributed valuable ideas and data to the art of water treatment for specific purposes. The conference was held in Pittsburgh, Pa., on November 9 and 10, and arranged by the Water Conference Committee of the Society consisting of H. M. Olson, chairman, Max Hecht, vice-chairman, J. R. McDermet, D. S. McKinney, E. P. Partridge and J. C. Warner.

Salts in Steam

Various theories of boiler water contamination were discussed by Frederick G. Straub, Research Professor of Chemical Engineering, University of Illinois, who stated that laboratory tests were conducted to determine if the salts present in boiler waters were soluble in the steam. The results indicated that there is an appreciable amount of sodium hydroxide and sodium chloride dissolved in steam at pressures above 1500 psi. The solubility in the steam increases as the concentration of the salts in the boiler water increases. When superheated steam is brought in contact with solid salt, such as sodium chloride, it dissolves much more salt than saturated steam over a dilute salt solution. These results indicate that the solubility theory appears to present a very clear picture of why turbine blade deposits form.

Reasoning that since sodium hydroxide is the aggressive agent in promoting caustic embrittlement, T. E. Purcell, General Superintendent of Power Stations, and S. F. Whirl, Chief Chemist, Duquesne Light Co., stated their conclusion that the most logical and direct method of protection against this chemical action is the exclusion of all alkalies which yield this substance when the boiler water is concentrated. To this end, a method of chemical treatment was developed wherein only phosphate, no sodium hydroxide, alkalinity is maintained in boiler water. This is accomplished by controlling the pH of boiler water according to a curve relating the pH to phosphate ion concentration in water solutions of trisodium phosphate.

The results of 42 tests with the Schroeder embrittlement detector on operating boilers were presented. In 21 of these, the A.S.M.E. embrittlement ratios were maintained. All but 3 of the specimens failed and in these cases, the tests were of less than 90 days' duration, which was found to be the minimum length of time required for consistent behavior. A total of nine tests has been run with the coordinated phosphate-pH control method of treatment. Not a single specimen has cracked, even though the test period was extended to 6 mo.

Slime and Algae Control

Microbiological slimes, according to J. A. Holmes, National Aluminate Corp., consist of algae, capsulated bacteria, molds and yeast-like fungi, with occasional iron-bearing, and sulphate-reducing bacteria. Their prevalence in cooling water, he says, is increasing, these organisms growing almost anywhere, although the presence of calcium and carbon dioxide, aeration, certain types of organic materials, and temperatures affect their growth. How chlorine, copper sulphate, potassium permanganate, chromates, and phenol derivatives are used for prevention of microbiological slimes was described. The phenol derivatives act as an inhibiting agent to prevent the growth of the organisms.

The chief advantages of the phenol derivatives are their efficiency in the presence of large amounts of organic materials, noncorrosive to metals, ease in application, and effectiveness on certain types of mold and bacterial growths. The phenol derivatives are used chiefly in recirculating systems where the treatment has an opportunity to concentrate and remain in the system. Control of treatment can be by tests for residual or by visual observation of the water. Phenol derivatives, he stated, do not affect the ordinary chemicals used for stabilizing or preventing scale in cooling systems such as phosphates or organic materials. However, the efficiency of the stabilizing treatment is greatly impaired by the presence of too many micro-organisms.

In discussing the effect of water conditions on condensers, pumps and heat exchangers, S. E. Tray, Chemical Engineer, Allis-Chalmers Mfg. Co., emphasized the fact that the operation of surface condensers is affected by both steam and water conditions. On the water side the presence of scale and slime will considerably reduce the heat transfer rate, while on the steam side difficulties arise largely from corrosion and erosion from dissolved gases and moisture in the steam. In general the corrective measures include the prevention of scale and the elimination of algae by chemical treatment and the removal of dissolved gases for corrosion protection. The problems in heat exchangers are similar, but are intensified by the higher temperature range in which they operate.

Outages are reduced considerably, he said, by the selection of proper materials for the construction of the various equipment. Condenser tubing is an excellent example of this in that there is a wide choice of alloys available, each of which has its particular field of application. Resistance to steam impingement and vibration is of equal importance as resistance to corrosion. Due to the present emergency, a number of alloys are on the restricted list and as a result substitute materials are receiving careful study.

The performance and service of the various pumps in the feedwater cycle are largely dependent on the

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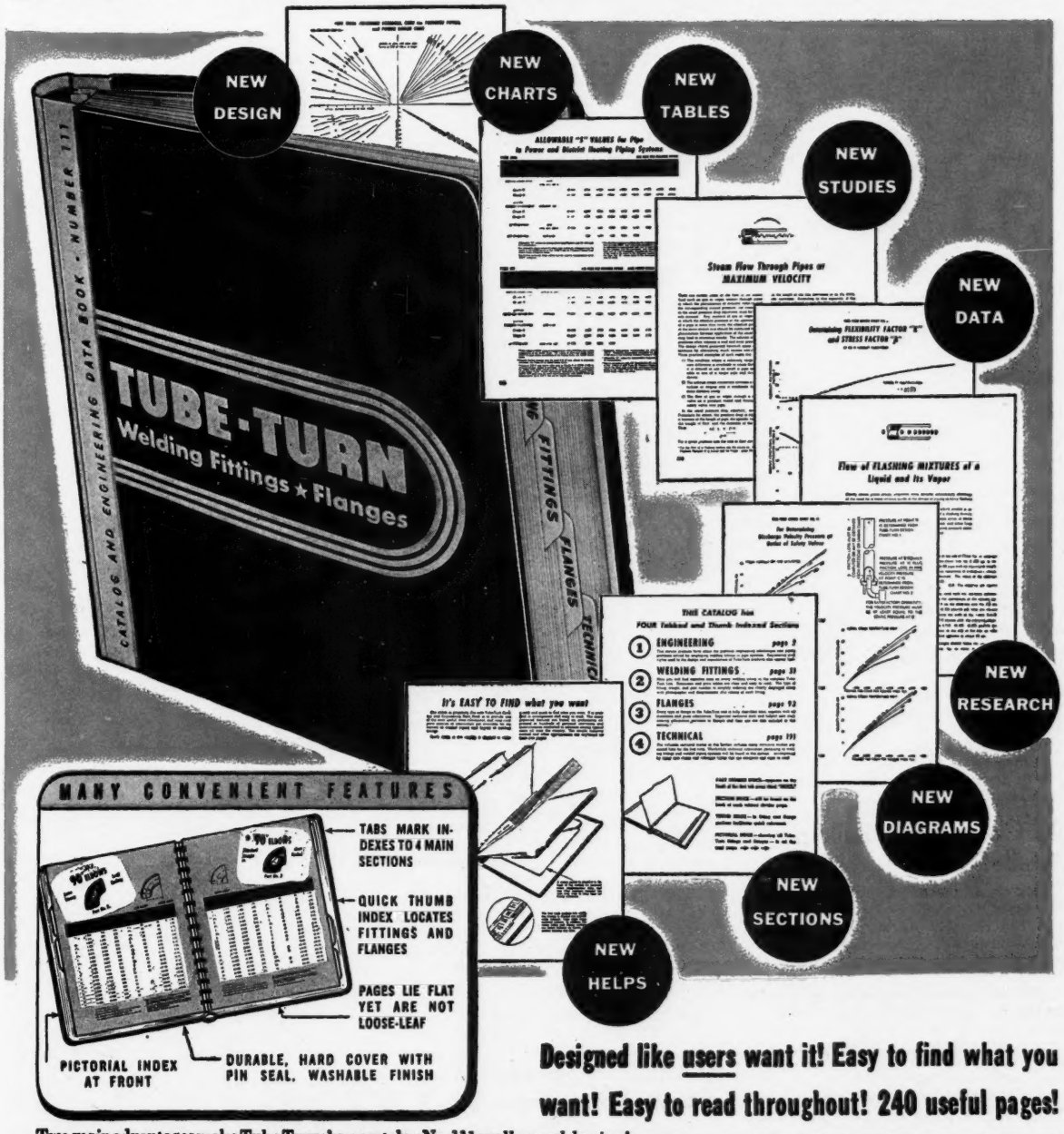

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chemical characteristics of the water. These characteristics also govern the choice of materials of construction. Generally speaking, water conditions will be established for the benefit of the boiler and turbine and hence the pump materials must be selected with that in mind. Dissolved gases and scale forming salts comprise the chief operating problems in pumps.

Water conditioning equipment now being produced is all for war purposes, stated S. B. Applebaum, vice-president, The Permutit Co., in his paper on water treating equipment for war industries. Due to the scarcity of critical materials, special designs have been developed such as wood gravity units with wood false bottoms and porcelain strainers, concrete false bottoms sectionally poured outside before placing, pressure wood filters and softeners, waterproof plywood baffles and flumes for precipitors, and rubber substitutes.

He indicated that among the water treatment methods favored during this emergency are hydrogren zeolite instead of hot process, lime pretreatment for cooling water plus zeolite for boilers, silica removal, hot process where raw water is preheated, automatic plants for gravity filters and gravity zeolite softeners, demineralizing plants.

War News From the Industrial Front

Stainless Steel, Iron and Steel Barred

USE OF stainless steel in more than 75 products, ranging from coffee pots and cutlery to farm machinery and hot water heaters will be prohibited under the terms of a revised iron and steel conservation order (M-126) announced November 5 by the WPB.

Effective immediately, delivery of stainless steel for products on a new List S is prohibited. For a period of 30 days, beginning November 5, manufacturers may use, out of inventories, up to 50 per cent of the average monthly stainless steel consumption for such products in 1941.

At the same time, the revised order adds about 100 items to List A, which prohibits delivery of iron and steel, effective immediately, and prohibits the manufacture of the listed items with any type of iron and steel after 30 days, and assembly after 60 days.

No Copper for Building Installations

INSTALLATION of copper in buildings has been reduced to practically zero with the issuance of an amendment to Supplementary Conservation Order M-9-c-4 by the director general for operations.

The amendment continues to restrict the use of copper building products for repairs to 25 lb. or less and permits these small amounts to be used only when they were in the possession of the user on October 27.

Users formerly could purchase metal for such installations. The effect of the amendment is to prevent the purchase, sale, delivery and use of any copper for installation in buildings so that stocks of such copper products in the hands of hardware stores, chain stores, warehouses, dealers, plumbers, contractors and others may be acquired by the Government and remelted for war use.

Magnesium Control Extended

TO CONTINUE control over the country's magnesium supply, the magnesium order M-2-b was extended from October 30 to December 31, by an amendment issued by the director general for operations. Originally, it was to have expired on October 31.

Oil Shipments to East Increase

TANK CAR shipments of oil to the East rebounded to 838,163 bbl. a day during the week ended October 17—up 71,753 bbl. a day from the previous week—Petroleum Coordinator for War Ickes announced October 23.

By loading an average of 3953 tank cars daily, petroleum shippers checked a 3-weeks' decline in the rail movement of oil to the East.

Extension of Pipe Line to East to Begin

EXTENSION of the world's largest oil pipe line, from southern Illinois to the East Coast, will begin in December as the result of allocation of the necessary steel by the WPB, Petroleum Coordinator for War H. L. Ickes said October 26.

The 857-mi., $60,000,000 extension will assure a direct daily pipe line delivery of 300,000 bbl. of crude oil for products to the eastern seaboard. Actual work awaits only the completion of the leg now being laid between Longview, Tex., and Norris City, Ill., and the transfer of construction crews to work sites along the routes to the East Coast.

Production Schedule for Heavy Power Equipment

PROCEDURES for the production scheduling of heavy power and steam equipment are established in Amendment No. 4 to Limitation Order L-117, issued November 2 by the WPB. Manufacturers of power equipment will submit monthly reports covering existing production schedules. These schedules will be reviewed and, if necessary, revised by the WPB.

Production scheduling has been devised as a means of reconciling the heavy demand for power equipment with the limited production facilities of the industry. Production schedules must be so arranged as to assure delivery of large items of power equipment in time to meet the requirements of our national power program. Furthermore, since a single power installation may require many items of equipment produced in separate manufacturing plants, it is important to integrate the delivery dates of such items.

Used Equipment Can Be Sold

MANUFACTURERS and processors—as well as merchants, farmers, and artisans —may sell their used equipment and supplies without reference to ceilings established by the general maximum price regulation, the OPA announced November 3.

Construction Industry Under Price Control

A NEW regulation providing specialized price control for the vast American construction industry was issued October 31 by Price Administrator Henderson.

The regulation covers all construction and maintenance services and sales in which contractors, builders, installers, and erectors furnish building or industrial equipment or materials, together with the labor or services required for actual construction, installation, or service.

The new controls are contained in Maximum Price Regulation No. 251—Construction and Maintenance Services and Sales of Building and Industrial Equipment and Materials on an Installed or Erected Basis—and became effective November 5.

Gypsum, Substitute for Metal, Lumber

IN KEEPING with conservation orders limiting consumption of strategic materials needed for the war effort, Federal agencies engaged in necessary war construction are turning to the use of noncritical materials as substitutes for metal and lumber. Unique among materials that are available for the purpose and at the same time adaptable to unusual construction demands is ordinary gypsum.

Tests of the strength factors and fire-resistant qualities of the several types of laminated gypsum products and poured gypsum roofing have been conducted by manufacturers, with satisfactory results.

The WPB building materials branch, through its gypsum roofing and insulation products section, is assembling technical data. Chief of the section is Erwin M. Lurie. Inquiries should be addressed to that section.

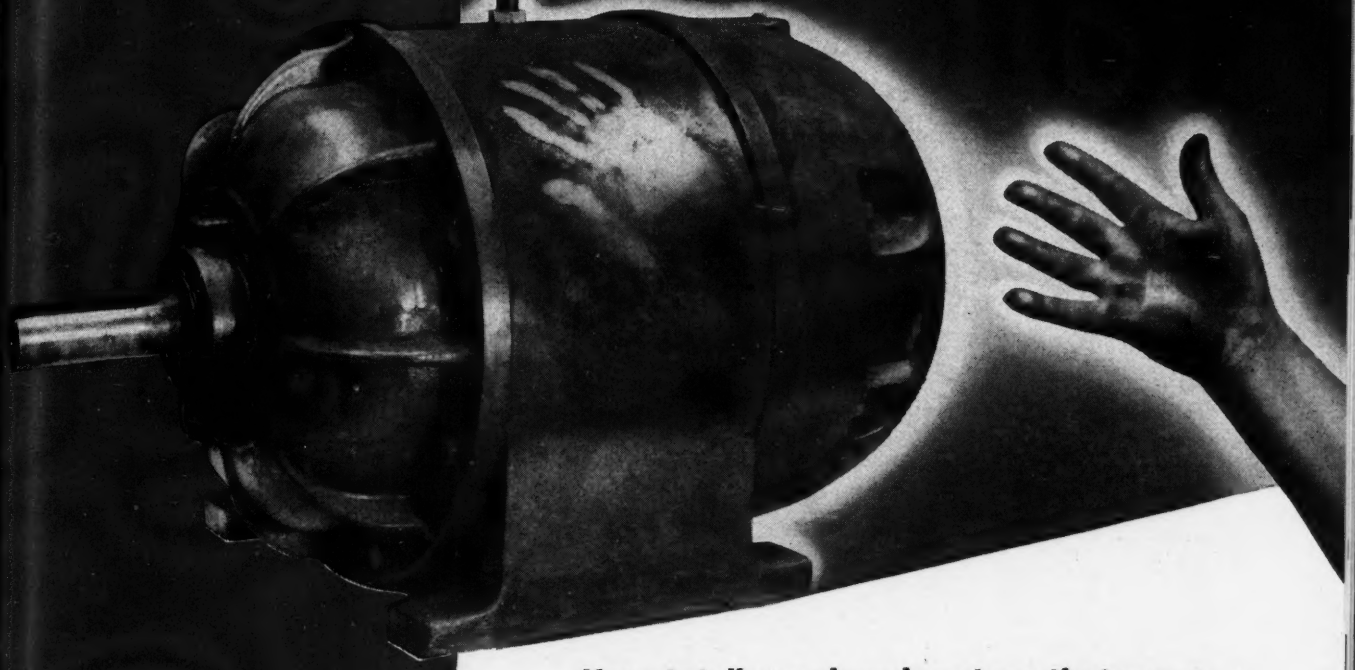
Construction Machinery Under Allocation

ALL construction machinery and equipment was placed under allocation control November 9 by the director general for operations, with the issuance of Limitation Order L-192, stopping production for civilian use of certain types of equipment needed for the armed services. The restricted machinery, as listed in Schedule C of the order, will be manufactured hereafter only for use of the military.

NOW... Listed by
Underwriters' Laboratories, Inc. for

COAL DUST..COKE DUST CARBON BLACK

Another G-E FIRST in Motors For Hazardous Places



New totally enclosed motors that meet Class II, Group F, combustible-dust hazards

As a part of its full line of motors for hazardous locations, General Electric can now supply motors specifically listed by the Underwriters' Laboratories to meet the dangers of combustible dusts included in Class II, Group F, of the National Electrical Code. Polyphase induction motors of this construction are available from 1 to 75 hp, single-phase types to 10 hp, direct-current types to 30 hp. Vertical motors and gear-motors are also included.

Dust-tight joints, including accurately rabbetted end-shield fits, plus a labyrinth seal and close-clearance bearing lips along the shaft, exclude dust from winding and bearings. External operating temperature at permissible overloads is well below the ignition point of the specified dusts. A one-piece, nonsparking fan (for fan-cooled sizes) assures effective cooling. Easy lubrication and servicing features are part of the well-planned design. For complete details, call or write your local G-E office. *General Electric, Schenectady, N. Y.*

BUILDER OF TRI/CLAD MOTORS
REG. U.S. PAT. OFF.

GENERAL ELECTRIC

750-165-5030

METAL DUST . . . ACETONE
TOLUOL . . . GASOLINE
COAL DUST...GRAIN DUST

Name your hazard—
this family can meet it

No single enclosed or explosion-proof motor is recommended for all types of hazardous service. General Electric has pioneered in producing a family of motors to meet the dangers of specific gases, vapors, liquids, and dusts. For some hazards, only G-E motors are listed by Underwriters' Laboratories, Inc. Our engineering staff can help you pick the *right* motor, control, and other auxiliary equipment for uninterrupted war production.

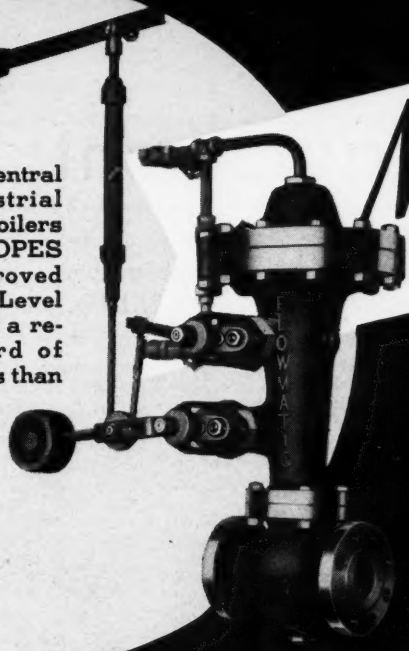
The Navy "E" for Excellence has been awarded to 27 G-E plants manufacturing equipment for ships

1942 NATIONAL POWER SHOW EXHIBITORS

Madison Square Garden, New York City, November 30 to December 4

Space No.	
222	American Artisan, Chicago, Ill.
131	American Brass Co., The, Waterbury, Conn.
431	American Car & Foundry Co., New York, N. Y.
313	American Pulley Co., The, Philadelphia, Pa.
3	American Society of Mechanical Engineers, The, New York, N. Y.
105	Ampco Metal, Inc., Milwaukee, Wis.
221	Andmar Co., New York, N. Y.
314	Armor-Clad Co., Newark, N. J.
705–707	Atlas Press Co., New York, N. Y., Kalamazoo, Mich.
232	Baldwin Belting & Leather Co., Inc., New York, N. Y.
111	Baldwin-Hill Co., Trenton, N. J.
331–332–333	Barrett-Cravens Co., Chicago, Ill.
416	Black-Sivalls & Bryson, Inc., Kansas City, Mo.
608–610	Boston Gear Works, Inc., North Quincy, Mass.
511	Brickseal Refractory Co., Hoboken, N. J.
528	Bridgeport Brass Co., Bridgeport, Conn.
205	Brooke Engineering Co., Inc., Philadelphia, Pa.
740	Brown Corp., W. R., Chicago, Ill.
509	Burgess Battery Co., Chicago, Ill.
231	Cambridge Instrument Co., Inc., New York, N. Y.
307	Canadian Radium & Uranium Corp., New York, N. Y.
212	Carborundum Co., Niagara Falls, N. Y.
700	Clements Mfg. Co., Chicago, Ill.
415	Coal Specialties Co., New York, N. Y.
228	Conover-Mast Corp., New York, N. Y.
712–713–714	Continental Machines, Inc., S. Minneapolis, Minn.
406	Cramer Co., Inc., The R. W., Centerbrook, Conn.
326–328	Diesel Publications, Inc., New York, N. Y.
329	Dixon Crucible Co., Joseph, Jersey City, N. J.
712–713–714	Doall Eastern Co., Inc., New York, N. Y.
206	Dodge Mfg. Corp., Mishawaka, Ind.
740	Dremel Mfg. Co., Racine, Wis.
531	Edison, Inc., Thomas A., Instrument Division, West Orange, N. J.
312	Eutectic Welding Alloys, Inc., New York, N. Y.
513	Falstrom Co., Passaic, N. J.
213	Foley Mfg. Co., Minneapolis, Minn.
428	Foster Engineering Co., Newark, N. J.
306	Garlock Packing Co., The, Palmyra, N. Y.
420	Graver Tank & Mfg. Co., Inc., East Chicago, Ind.
728	Gray-Mills Co., Inc., Chicago, Ill.
731	Grob Bros., Grafton, Wis.
308	Gulf Oil Corp., Pittsburgh, Pa.
613	Hahn Engineering Div., Luria Steel & Trading Corp., New York, N. Y.
731–733–735–737–746–748–750	Halpern & Co., Wm., New York, N. Y.
533	Hartzell Propeller Fan Co., Piqua, Ohio
222	Heating, Piping & Air Conditioning, Chicago, Ill.
424–426	Heating & Ventilating, New York, N. Y.
409	Honan-Crane Corp., New York, N. Y.
221	Hoppes Mfg. Co., The, Springfield, Ohio
507	Hotstream Heater Co., Cleveland, Ohio
734–736	Independent Pneumatic Tool Co., Chicago, Ill.
424–426	Industrial Press, New York, N. Y.
229	Industrial Sheet Metal Works, New York, N. Y.
318	Industry & Power, St. Joseph, Mich.
629	Insto-Gas Corp., Detroit, Mich.
128	Ironbound Box & Lumber Co., Inc., Hillside, N. J.
502	Iron Fireman Manufacturing Co., Cleveland, Ohio
512	Johns-Manville, New York, N. Y.
720	Johnson Mfg. Corp., Albion, Mich., New York, N. Y.
221	Jones, Joseph C., New York, N. Y.

Space No.	
222	Keeney Publishing Co., Chicago, Ill.
6	Kent Co., Inc., The, Rome, N. Y.
405	Lebanon Steel Foundry, Lebanon, Pa.
731	Lee & Sons Co., K. O., Aberdeen, S. D.
128	Lever Co., George C., New York, N. Y.
517–519	Lord Mfg. Co., Erie, Pa.
211	Lovejoy Flexible Coupling Co., Chicago, Ill.
209	Lyon-Raymond Corp., Greene, N. Y.
4	McGraw-Hill Publishing Co., New York, N. Y.
731	Machinery Mfg. Corp., Los Angeles, Calif.
703	Mall Tool Co., Chicago, Ill.
539	Marl Company, The, New York, N. Y.
316	Melrath Supply & Gasket Co., Inc., Philadelphia, Pa.
310	Metallizing Co. of America, Inc., New York, N. Y.
228	Mill & Factory, New York, N. Y.
740	Mill Factor Products Co., New York, N. Y.
740	Millersburg Reamer & Tool Co., Millersburg, Pa.
532	Morse Magneto Clock Co., New York, N. Y.
402	Nash Engineering Co., South Norwalk, Conn.
108	Nathan Mfg. Co., New York, N. Y.
220	Okadee Co., The, Chicago, Ill.
716–718	Oster Mfg. Co., Cleveland, Ohio
107–109	Owens-Corning Fiberglas Corp., Toledo, Ohio
605	Packless Metal Products Corp., New Rochelle, N. Y.
204	Parker Appliance Co., The, Cleveland, Ohio
110	Paulson & Son, Inc., Thomas, Brooklyn, N. Y.
516	Philadelphia Gear Works, Philadelphia, Pa., New York, N. Y.
221	Piezoelectric Laboratories, Staten Island, N. Y.
226	Pike & Co., E. W., Elizabeth, N. J.
7 & 701	Porter-Cable Machine Co., The, Syracuse, N. Y.
4	Power, New York, N. Y.
311	Power Plant Engineering, Chicago, Ill.
706–708	Precise Tool & Mfg. Co., Farmington, Mich.
505	Proportioneers, Inc., Providence, R. I.
617–619–621	Rapids-Standard Co., Inc., Grand Rapids, Mich.
302	Reed Roller Bit Co., Houston, Texas
303	Reeves Pulley Co. of N. Y., Inc., New York, N. Y.
403	Reintjes Co., Geo. P., Kansas City, Mo.
120–122–124	Revolvator Co., No. Bergen, N. J.
309	Rhoads & Sons, J. E., 33 N. Sixth St., Philadelphia, Pa.
510	Ric-wiL Co., The, Cleveland, Ohio
627	Robinson, John R., New York, N. Y.
632	Roy Pumps, Milton, Philadelphia, Pa.
305	Sarco Co., Inc., New York, N. Y.
730–732	Schrader's Son Div., A. Scovill Mfg. Co., Brooklyn, N. Y.
404	Service Caster & Truck Co., New York, N. Y.
408	Socony-Vacuum Oil Co., New York, N. Y.
410	Southern Power & Industry, Atlanta, Ga.
317–319	Spencer Turbine Co., The, Hartford, Conn.
411	Sperry Products, Inc., Hoboken, N. J.
221	Squires Co., C. E., Cleveland, Ohio
417–419–421	Tek Bearing Co., New York, N. Y.
503	Titeflex Metal Hose Co., Newark, N. J.
229	Tool & Equipment Supply Co., New York, N. Y.
207	Trabon Engineering Corp., Cleveland, Ohio
740	Union Tool Co., Orange, Mass.
604-606	Voss Co., J. H. H., New York, N. Y.
106	Waldron Corp., John, New Brunswick, N. J.
722–724	Walker-Turner Co., Inc., Plainfield, N. J.
415	Ward, Arthur T., New York, N. Y.
731	Wells Mfg. Corp., Three Rivers, Mich.
709	Whitney Metal Tool Co., Rockford, Ill.
407	Wilson Chemical Feeders, Inc., Buffalo, N. Y.
104	Wright-Austin Co., Detroit, Mich.
622–624	Yale & Towne Mfg. Co., Philadelphia, Pa., New York, N. Y.
221	Yoder Co., Cleveland, Ohio



More than-- FEED WATER CONTROL

• Over 600 large central station and industrial type water tube boilers are serviced by COPES Flowmatic, the proved Steam Flow-Water Level Regulator. This is a remarkable record of acceptance for less than five years on the market. Write for general catalog on the complete line of COPES Feed Water Regulators.

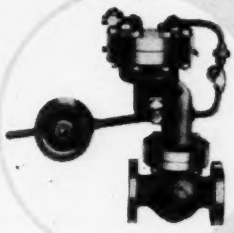
MENTION COPES and engineers think of boiler feed water control—COPES designed and built a complete line of Pump Governors even before COPES Feed Water Control was introduced. Over 33 years of valve control experience has produced a wide line of allied equipment for the flow control of steam, gas, liquid and chemicals, a few of which are illustrated below. Consult COPES for modern valve control equipment in your plant.

COPES Desuperheaters

COPES Desuperheaters completely or partially remove the superheat from steam to be used for process or for auxiliaries designed for reduced temperature steam. This ruggedly built Desuperheater utilizes the spray principle. Sizes from 2" through 14"—Bulletin 405.

COPES Differential Valves

These valves provide effective differential pressure control in the individual boiler feed line where any type of feed regulator is used. May be used for other services to maintain a constant differential pressure across control valves or orifices. Write for bulletin.

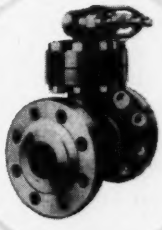


COPES Pump Governors

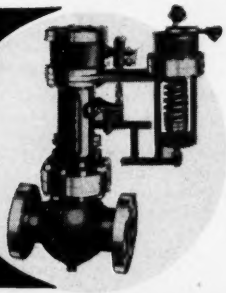
COPES Pump Governors control within close limits any excess pressure from 15 to 150 pounds. Used on simplex or duplex pumps and on turbine or motor-driven centrifugal pumps, sizes 1½" through 6". Write for bulletin.

COPES Balanced Valves

This popular COPES BI Valve, part of so many COPES products, is widely used throughout industry. They are activated by floats, temperature, pressure or any other type of controllers to control the flow of any kind of liquid, steam or gas. This COPES BI Valve is by far more perfectly balanced than any other make of valve of which we know about. Write for data.



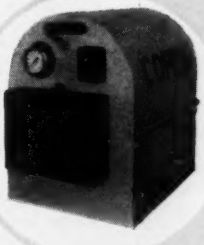
COPES Reducing Valves



Types 3-SH-2C, illustrated, designed for water or steam service where the reduced pressure limits are within 15 to 250 lbs. p.s.i. gauge. Any desired degree of sensitivity is obtained through adjustable levers. Available in many styles and sizes from 1" through 14". Write for bulletin.

COPES Pumping Units

COPES Motor Driven Dual Pumping Units, a dependable source of operating pressure for relay-operated valves—eliminates need of running air, oil or water pressure lines from a distant point. Either pump may be used as the standby unit. Adaptable for other services within its capacity of three gallons per minute at 75 pounds pressure. Write for data.



COPES FEED WATER REGULATORS AND ALLIED EQUIPMENT

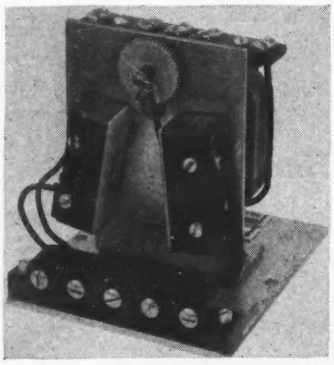
NORTHERN EQUIPMENT COMPANY · 1121 GROVE DRIVE, ERIE, PA.

New Equipment

Information that you desire about any equipment will be gladly furnished without obligation. WRITE POWER PLANT ENGINEERING.

Motorelay

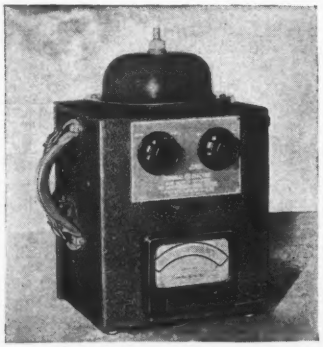
A NEW floating contact device, for use in installations where the control current exceeds the contact rating of the control instrument, has been announced by Barber-Colman Co., Rockford, Ill.



This device known as Motorelay, consists of a shaded pole reversible geared head motor, totally enclosed switches and switching mechanism. An enclosed type drawn steel cover is available. Switch contacts have a non-inductive load capacity of 10 amp. at 110 or 230 v. a.c., and a control circuit current of 0.35 amp. at 25 v.

Electronic Crest Voltmeter

THE electronic crest voltmeter announced by the General Electric Co., Schenectady, N. Y., is designed to measure ignition voltages of internal combustion engines; surge voltages caused by corona and surface discharges in the insulation on such electric equipment as motors, generators, and cables; and other repeated-impulse voltages up to 30,000 v.



The instrument, weighing 23 lb., fills the need for a portable crest voltmeter for both laboratory and production testing. It is suitable for field measurement, such as trouble shooting and the determination of factual operating conditions, and can also be used for testing aircraft engines in flight.

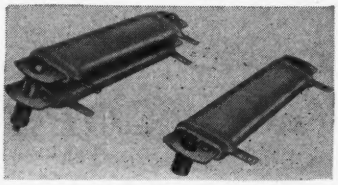
The crest voltmeter can be used in areas where no electric power is available, since it has a self-contained battery power supply. It can be moved readily to any location for testing purposes—a valuable feature when the equipment to be tested is too large to be moved conveniently.

The voltmeter is equipped with an aircraft-instrument movement to provide resistance to vibration. It can be supplied marked and calibrated for any of the following scale ranges: 0-10,000 v.; 0-20,000 v., 0-30,000 v.

Vitrohm Strip Resistors

VITROHM strip resistors announced by the Ward Leonard Elec. Co., Mt. Vernon, N. Y., are especially suited to applications in aviation, radio and installations where space limitations and high unit space watt ratings are required.

These resistors employ a strong, flat refractory core for the resistance wire winding. Terminals are mechanically banded and spot welded in position on the core; the core and windings are then sealed in a fused-on Vitrohm enamel.



Each unit is fitted with a self-sustained mounting bracket and spacer. These spacers and end brackets are riveted to metal strips that extend through the core providing additional heat radiating facilities.

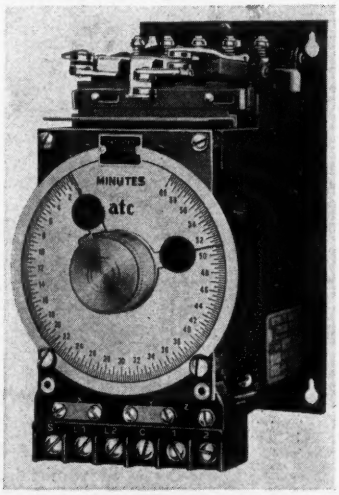
The resistors are available in sizes ranging from 1½ to 6 in. in length with ratings of 30 to 75 w.

Cycle-Progress Timer

WHERE timed operation on a stop-cycle basis is required for machines or processes and where it is desired to have an indication of the time elapsed or time to end of cycle, Automatic Temperature Control Co., 34 E. Logan St., Philadelphia, Pa., announces its improved cycle-progress timer for accurately controlling such applications as chemical treatment of boiler water and coal feed control.

The timer is available for operation from 110 or 220 v. 25, 50 or 60 cycles, and is driven by a telechron motor equipped with a simple no-locking knob. Contacts will carry loads to 25 amp. at 110 v. a.c., non-inductive. Dials may be selected from 15 min., 60 min., or 2, 10, 20, 40, or 60 hr.

Units provide for maximum flexibility, allowing for field adjustment of three colored slides and three bridges to select desired contact action for various operating conditions. Load and timer's motor-clutch circuits are normally wired independently but they can be wired together by simply using a jumper across L2 and C terminal posts.

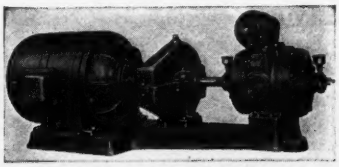


These timers are mounted in sheet steel cases with circular cut-outs; knob adjustment is external or internal, depending upon the case selected. They may be obtained for resetting or non-resetting action upon power failure.

Steam-Jacketed Pump

A NEW and simplified steam-jacketed pump was recently announced by the Blackmer Pump Co., Grand Rapids, Mich.

These units are applicable for handling such materials as palm oil, lard, tar, greases and similar liquids that must be processed or transferred while hot. The new steam-jacketed heads are made of cast semi-steel, with threaded intake and exhaust steam ports, and drain plugs. They are suitable for steam pressures up to 125 lb.



The pump is equipped with heavy bearing construction which is said to eliminate shaft whip and distortion. Pumps for pressures in excess of 100 psi are furnished with anti-friction bearings. The stuffing boxes are deep with ample number of packing rings. Standard Blackmer units in capacities from 20 to 700 g.p.m. and pressures up to 300 psi are available with the new steam-jacketed head. They are furnished with either single or double reduction gear drive and as single or multiple pump units.

"Easier to Use"

MIDWEST BUTT-WELDING ELBOWS

Welders who have worked on all kinds of piping jobs frequently report that Midwest Welding Elbows are "easier to use" . . . this means an all important saving in time. Layout time is saved because all pipe can be cut in advance according to the drawings . . . time for lining up and tack welding is also reduced.

Midwest Butt-Welding Elbows are "easier to use" because of their greater dimensional accuracy and consistent uniformity. These qualities are inherent in Midwest Elbows because of their unique method of manufacture: they are *sized in compression* (not extruded or stretched) and an exact included angle is the result of special fixtures and tools developed by Midwest for machine-beveling the ends.

Bulletin WF-41 shows the other advantages of Midwest Elbows . . . and the complete line of Midwest Welding Fittings. Write for a copy.

MIDWEST PIPING & SUPPLY COMPANY, Inc.

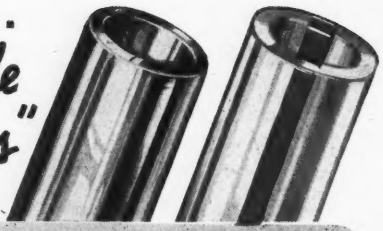
Main Office: 1450 So. Second St., St. Louis, Mo.
Plants: St. Louis, Passaic (N. J.) and Los Angeles

Sales Offices: Chicago—949 Marquette Bldg. • Houston—229 Shell Bldg. Los Angeles—520 Anderson St. • New York—(Eastern Division) 30 Church St. • San Francisco—535 Call Bldg. • Tulsa—533 Mayo Bldg.

MIDWEST WELDING FITTINGS SAVE TIME, IMPROVE THE DESIGN, AND REDUCE THE COST OF PIPING SYSTEMS

WHY USERS CALL IT . . .

"the Unbreakable Gauge Glass"



SONDERGLASS is virtually unaffected by sudden temperature changes or high steam pressures because of its specially developed double-strength construction.

The inside of a SONDERGLASS tube expands in proportion to the temperature of the steam or water, while the outside resists the effect of sudden cold drafts. In repeated tests SONDERGLASSES have been dipped in hot oil 450 deg. F., then plunged into cold water without breaking. They have withstood pressures up to 1000 lb. without bursting. They are extra strong, long lasting, economical.

Decide today to stop costly gambling with men's eyesight. One poor fellow blinded or mutilated for life may cost you a thousand times more than the slight expense required to see that every water column glass in your plant is SONDERGLASS.

IN 2 POPULAR TYPES

1. CLEAR

2. REFLECTING

ORDER FROM YOUR DEALER OR DIRECTLY FROM US

SONDERGLASS

A. W. CHESTERTON CO.

64 INDIA STREET BOSTON, MASS.

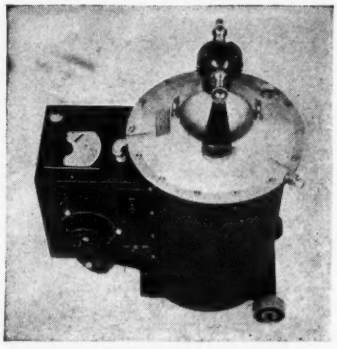
CHANGE OF ADDRESS

To avoid missing an issue or paying for forwarding postage be sure to send a change of address to our office. Changes received by the 20th of the month can be made effective for following month's issue.

Oil and Insulation Testing Set

An oil and insulating testing set, 35,000 v., which can be converted for high-potential tests on a variety of materials and products is announced by the Transformer Division of the General Electric Co., Schenectady, N. Y.

The set consists of a 2-kv-a., 35,000 v., liquid-immersed testing transformer; an air-cooled variable-voltage autotransformer; an air ciruit breaker for opening the circuit after the test is completed; an oil-testing receptacle; a push-button station; and a double-range voltmeter for accurate indication of the insulation breakdown voltage. All these parts are mounted as a unit on a three-wheel ball-bearing truck for easy portability.



The oil-testing receptacle contains the test gap and is so mounted on the high-voltage terminals that simply tilting the receptacle empties the tested oil into a drain pan in the transformer cover. The oil is then withdrawn from the pan through a drain cock. The receptacle is suitable for testing Pyranol and other askarels, as well as oil.

The oil-testing receptacle is removed to convert the set for standard high-potential tests on such materials and equipment as sheet insulation, cable, small transformers, rubber gloves, small motors and generators, circuit breakers, line materials, bushings and insulators. The testing set is provided with a 15-ft. flexible cord and a plug for connection to any 115-v. or 230-v. a.c. outlet.

Low-Pressure Flow Transmitter

The new Cochrane Style H transmitter, designed specifically for the measurement of low static pressure gases where low differential and resultant low permanent pressure loss is of prime importance, is announced by Cochrane Corp., Philadelphia, Pa.

In this transmitter differential pressure created by flow is applied to the opposite sides of the oil sealed bell with the pressure from the connection before the primary element being applied under the bell and the downstream pressure above the bell. A metallic displacer in the central reservoir is submerged in mercury to a point where the bell and displacer just float when no differential pressure is exerted. A flow of gas resulting in a change of differential pressure raises the bell, lifting the displacer from the mercury with the change in buoyancy

Answering that BIG QUESTION of deliveries

on ELGIN WATER CONDITIONING PRODUCTS

Three ways we can serve you RIGHT NOW—

1 WATER CONDITIONING EQUIPMENT

Available Promptly for essential wartime needs

ELGIN Water Conditioning Equipment is recognized as essential for war production plants and for army, navy and maritime use. For such needs we *can* supply it *promptly*. Major products are listed here. But since our line covers a broad range, we invite inquiries on any type or method.

- Zeolite Water Softeners
- Boiler Water Conditioning Systems
- Deconcentrators (for removing, sludge, mud and suspended matter from boilers)
- Continuous Blowdown Heat Exchangers
- Water Filters and Purifiers

2 WATER TREATING CHEMICALS

Prompt Shipments for any need

ELGIN Water Treating Chemicals are solving many water conditioning problems—particularly where the use of mechanical equipment is restricted. Treatments are individually prescribed after complete analysis of water samples and engineering surveys. They include:

- Boiler Water Treatments
- Process Water Treatments
- Hot Water Treatments
- General Cold Water Treatments

(No charge for water analysis and consultation)

3 ZEOLITE for RECONDITIONING

Immediate Delivery for any zeolite water softener

NO priorities are needed for Elgin Zeolite refills which can greatly increase the capacity of your present zeolite softener. Immediate shipments from stock can be made on:

- Standard Greensand Zeolite
- High Capacity Greensand Zeolite (approximately double the capacity of ordinary greensand)
- High Capacity Synthetic Zeolite (approximately four times the capacity of ordinary greensand)

ELGIN takes over the whole responsibility

• The Elgin line is all-inclusive; so Elgin recommendations are necessarily *unprejudiced*. Our district engineer will call and arrange for water analyses and plant survey—made without charge or obligation. Recommendations are accompanied by complete engineering data such as drawings and facts about results to be obtained. When equipment is installed, erection is supervised by Elgin. Whether equipment or treatment is used, operation is supervised and checked by us to assure satisfactory operation. The success of Elgin Water Conditioning is a direct result of not only solving problems but *keeping them solved!*

Engineering data and layouts furnished on request. Write us today.

ELGIN SOFTENER CORPORATION, 136 N. Grove Ave., Elgin, Ill.

Don't Scrap USED DART UNIONS

...put them Back to Work

Your country needs all your *scrap* . . . but NOT the things that your plant can use again to good advantage, such as old Dart Unions.

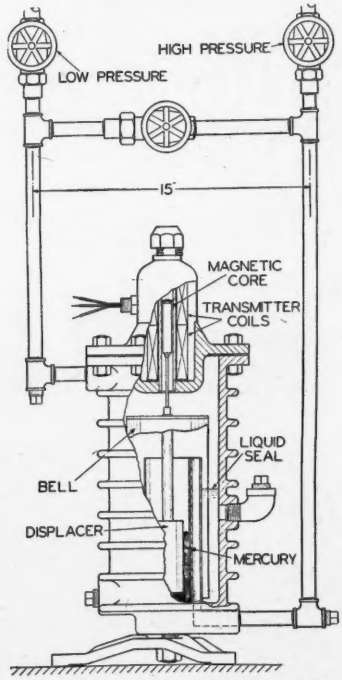
Even though a Dart has already given *plenty* of fine service, it can be put back on the job . . . *with tight-joint performance.* And the reasons *why* Darts can do this are found in the way Darts are MADE: their matched bronze seats, ground to "true-ball" surfaces . . . their air refined malleable iron bodies and nuts that resist rust and rough handling.

Today, you *need* your used Dart Unions—don't throw them away. And when you need *new* ones, get in touch with your supplier promptly.

DART UNIONS

E. M. DART MFG. CO., Providence, R. I.

being just sufficient to give a bell movement proportional to the differential pressure. The translation of bell movement to uniform-chart readings is accomplished by an individually calibrated cam.



The transmitter is designed for differentials of 2, 4, 6, 8 or 10 in. of water, standardization of design permitting altering the differential head by changing the displacer and amount of mercury in the central reservoir. Ease of accessibility to the interior parts of the transmitter permits quick and thorough cleaning of all parts and the sealing oil level can be quickly checked through the filling plug without removal of the top cover.

SHARE

Your Christmas Giving
With
The Salvation Army

WRITE

The Salvation Army
Into
Your Will

Add Them to Your Check List of Safety Measures

✓ Steel Frames
✓ Light Traps
✓ Fire-alarm Systems
✓ Fire Walls
✓ Sprinkler Systems
✓ Pyranol Transformers

. . . Because Pyranol Cannot Burn

FROM THAT ONE FACT SPRING MANY BENEFITS:

✓ YOU CAN INSTALL THEM INDOORS *SAFELY:* No Pyranol transformer has ever burned or contributed to a fire. Even if heat from a surrounding blaze ruptures the tank, the fire hazard will not be increased.

✓ VAULTLESS INSTALLATIONS ARE POSSIBLE: You can install them indoors or outdoors—in the basement, on the factory floor, on overhead beams, or on the roof. Such flexibility assures you major savings in time, floor space, and construction materials.

✓ PRIMARY POWER CAN BE RIGHT AT THE LOAD: Voltage regulation is improved, line losses are lowered, copper is saved—often up to 30,000 lb in large industrial installations.

AND BECAUSE THEY ARE *LIQUID-FILLED* THEY HAVE:

✓ ——A HIGH, *LASTING* DIELECTRIC STRENGTH—an important safeguard against damage from voltage surges caused by lightning and switching

✓ ——PRESSURE-TIGHT TANKS, which protect vital parts from dust, dirt, and sabotage

✓ ——A HEAT-STORAGE CAPACITY that is ideal for emergency overloads

PYRANOL* transformers fit naturally into your wartime campaigns for (1) safety, (2) stepped-up production, and (3) conservation of critical materials.

The absence of fire hazard will help you with campaign No. 1. A reliable power supply, easily installed *where you want it*, is an important consideration for No. 2. Fireproof vaults being unnecessary, vital construction materials are saved. Since Pyranol transformers can be located at the load center, the runs of secondary copper are greatly reduced. These are important factors in helping you with point No. 3.

Since the introduction of Pyranol, in 1932, more than 4,000,000 kva of new transformers have been built using this type of cooling and insulating liquid. Hundreds of users are finding that Pyranol transformers assure the lowest total installed cost commensurate with the highest degree of safety.

Ask your G-E representative for the complete story, or write for Bulletin GEA-2048D. *General Electric Company, Schenectady, N. Y.*

**Pyranol is the G-E trade name for askarel.*

The Navy "E" for Excellence, has been awarded to 92,780 General Electric employees in six plants manufacturing naval equipment

Supervised Boiler and Condenser Cooling

System Protection at Moderate Cost!

We believe the true answer to your boiler water and condenser cooling system problem lies in competent supervision of water conditions by experts plus a simplified natural method of water correction. Our new Technical System does just that! Scheduled supervision and treatment based on frequent water analysis finds and remedies your trouble . . . specific organic formulas developed individually to fit your needs provide a simplified, natural correction. Send the coupon below for the new Technical System bulletin or have a Water Treatment Company engineer inspect your plant without obligation.

WHY NOT SEND THIS COUPON *NOW?* . . . to

American Radiator & Standard Sanitary
New York CORPORATION Pittsburgh

Akron, Ohio · Canton, Ohio · Cleveland, Ohio
Columbus, Ohio · Erie, Pa. · Fort Wayne, Ind.
Lima, Ohio · Mansfield, Ohio · Springfield, Ohio
Toledo, Ohio · Wheeling, W. Va.

BAILEY-FARRELL COMPANY
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☐ Please send the new Technical System bulletin.
☐ Have a Water Treatment Company engineer call.

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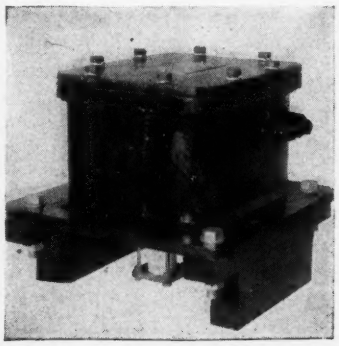
Company .....

Address .....

WATER TREATMENT COMPANY of America
1159 HODGKISS STREET · PITTSBURGH, PA.

Inerteen Transformer Detector

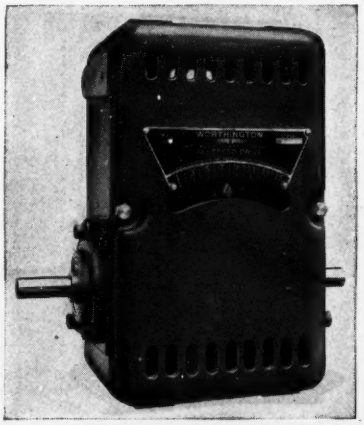
THE HCL detector for Inerteen transformers, a new method of protection for minimizing damage to transformer windings by its quick detection of small arcs, is announced by Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.



This device is said to be more sensitive and faster in operation than conventional pressure relief devices and may be used to give prompt warning of even very small arcs by detecting the presence of HCL gas formed by the decomposition of liquid. The detector will operate in approximately 85 sec. from a 1-kv-a. arc, when pressure might still be less than 2 lb. psi, which reduces the possibility of high pressures forming within the tank. The detector is easily installed either on new or existing transformers and can be used to operate an alarm or circuit breaker, thus disconnecting the transformer from the feeder.

Variable Speed Drive

A VARIABLE speed multiple V-belt drive, known as the Allspeed Drive, is announced by the Worthington Pump & Machinery Corp., Harrison, N. J. The



first of these to be made available is the model A which has a horsepower range from ⅓ to ¾ hp. with a speed ratio of 16 to 1; that is, any speed from ⅛ to twice the driving motor speed. This drive is said to be exceptionally compact, ball-bearing equipped, and so designed that it can be operated in any plane. It can also be directly coupled to any stand-

(Continued on Page 136)

AN IMPORTANT ANNOUNCEMENT TO ALL TUBE CLEANER BUYERS

Because it has become impossible for us to meet the ever increasing demand for Wilson Tube Cleaners and Wilson tube cleaning accessories in our plant at 47-28 37th Street, Long Island City, N. Y., we have purchased the building shown in the above photograph.

In our new home we will have available over three and one half times the floor space we had in our former plant. We have installed many new high speed machine tools and the greatly increased production capacity which these additional machines are giving us enable us to make more Wilson Tube Cleaners and accessories and also to make quicker shipments.

Write for the name of our representative nearest to you or ask for a copy of our NEW forty-page catalog which fully describes and illustrates the complete line of Wilson tube cleaning equipment.

INVEST IN AMERICA! BUY WAR BONDS AND STAMPS!

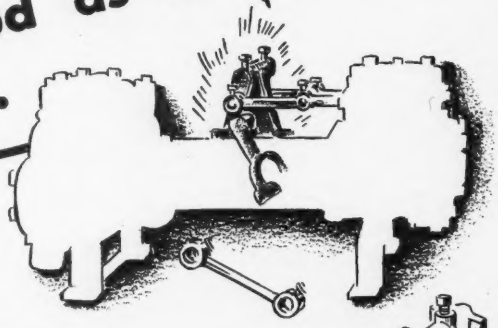
THOMAS C. WILSON, Inc.

PIPE AND TUBE CLEANERS EXCLUSIVELY

THE WILSON BUILDING

21-11 44TH AVE. LONG ISLAND CITY, N. Y.

a pump is only as good as its parts . .



. . . and your ability to obtain them!

Warren's reputation for the prompt and efficient handling of Repair Parts has long been an enviable one.

Now, during this emergency our efforts will be re-doubled . . . and while delays are certain to occur, you can as always, depend upon Warren to bend every effort to help you out in a "pinch."

A Warren Recommendation is Never a Compromise and Warren Repair Parts Service Seldom a Disappointment.

WARREN PUMPS

WARREN STEAM PUMP COMPANY, INC. WARREN, MASSACHUSETTS

Helpful Bulletins

BOILER PLANT EQUIPMENT

1 Integral Furnace Boiler — Illustrated bulletin G-34 gives complete data on integral furnace boiler, either stoker firing or oil burning. Can be quickly converted to burn whichever is the more economical fuel. Outstanding features of this unit are described in detail and cross sectional views show typical installations. The Babcock & Wilcox Co.

2 Ignition System—Bulletin outlines the Enco automatic retractable oil or gas ignition system for lighting-off pulverized coal with remote control. This system also serves as a standby for pulverized coal or other fuel when it is necessary to clear mill or feed pipes, replace fuses, etc. The Engineer Co.

3 Stoker Data—"Stoker Data and Specifications" is the title of an attractive publication telling you how to determine correct stoker sizes and how to specify stokers. Also contains stoker dimensions, coal-burning capacities and recommended setting heights for many different types of boilers. Combustion Engineering Co., Inc.

4 Combustion Control Handbook—A new edition of the Hays Combustion Meter Catalog has just been issued. This Bulletin 42-550 explains the purposes of a combustion meter and the relation of carbon dioxide to combustion efficiency. A schematic explanation is given of the operation of a combustion meter. Sent free on request. The Hays Corp.

5 Water Tube Boilers—Bulletin describes and illustrates a line of water tube boilers designed and built for highest efficiency. Data also available on drop forged steel valves, fittings, flanges, oil refinery, chemical plant and refrigeration equipment. Henry Vogt Machine Co., Inc.

6 Steam Generator — New Bulletin F9-2 tells how to get more steam generating capacity in a given space and simplify maintenance with the Keeler CP steam generator. Capacities to 100,000 lb. per hr. and pressures 125 to 500 lb. E. Keeler Co.

7 Coal Burning Data — Illustrated 24-page book "Coal" describes the mining, preparation, uses of coal from Pittsburgh seam in West Virginia. Contains many boiler diagrams, helpful data on improving fuel burning efficiency. Coal Bureau, Upper Monongahela Valley Assoc.

8 Pneumatic Spreader Firing—Helpful new booklet on Iron Fireman pneumatic spreader firing contains descriptions, capacities and operating data of interest to steam plant engineers. Also layouts and photos of 10 stoker installations. Iron Fireman Mfg. Co.

9 Soot Remover—Bulletin describes the Mohawk power-driven, easy-to-use combination scraper and blower for dislodging soot and slag from inside fire tubes in a hurry. Either steam or air driven. Brunt Equipment Co.

10 Multiple Spreader Stoker—"Burns Coal Like Oil" is the title of the new 12-page, board-bound brochure which describes the Fyr-feeder multiple spreader stoker and the work that it is doing in various Army, Navy and Defense Power Plants, as well as on oil conversion jobs. American Coal Burner Co.

HELPFUL BULLETINS

Practical answers to many wartime problems of plant operation and maintenance are found in the engineering bulletins offered by manufacturers. For your convenience we publish the following summary of helpful literature mentioned in this and recent issues of POWER PLANT ENGINEERING. To obtain copies of the bulletins and catalogs described, simply indicate the paragraph numbers on postcard below, detach and mail.

ELECTRICAL EQUIPMENT

11 Rectifiers — Ignitron Mercury-arc Rectifiers in the Steel Industry is the title of new 28-page Bulletin GEA-3827. Outlines various conversion-equipment problems in the steel industry and discusses applications of ignitron mercury-arc rectifiers in meeting these problems. Includes cross sections of the rectifier, comparative efficiencies of the three types of power-conversion units available to supply power to large d.c. systems in steel mills: the synchronous converter, the motor-generator set, and the ignitron mercury-arc rectifier. General Electric Co.

12 Lighting Guide—Up-to-the-minute information on the use of fluorescent luminaires for factories and offices is given in new lighting catalog. Includes diagrams, specifications, price lists. Martin-Gibson Light & Tile Corp.

13 Motor Finder — To help motor users fill their wartime needs with the least possible delay and to conform to WPB recommendations, this Motor Finder slide rule has been produced for quickly selecting the various types of squirrel-cage motors which cover a range of from ½ to 75 hp. Sent free on request. Allis-Chalmers Mfg. Co.

14 Plant Lighting — Booklet GES-3033 illustrates and describes the new Forlamp ballast for lighting war plants. The booklet contains data telling how the use of these lamps saves critical materials and power, as well as money. Three methods of converting plant to Forlamp illumination are shown diagrammatically. General Electric Co.

15 Switchgear — Horizontal drawout metal-clad switchgear in 100,000, 150,000 and 250,000 kv-a. capacities at 5000 and 15,000 v. is described and illustrated in Catalog 1110. It contains construction details and helpful dimensional data on the various types of switchgear available. Roller-Smith Co.

16 Resistance Starters — Semi-automatic resistance starters for manually starting polyphase squirrel-cage motors are illustrated and described in a new 4-page Bulletin 640. It gives details of application, standard features, operation and other important information on this line of starters. Allen-Bradley Co.

17 Fluorescent Lighting—A new 30-page catalog and handbook contains information on selecting the proper types and quantities of fluorescent lighting fixtures for a particular project. Included are illustrations of over thirty models with complete technical specifications, list of Recommended Minimum Standards of Illumination, and general engineering and maintenance information. Sylvania Electric Products, Inc.

18 Electric Power Guide—A handy engineers' pocket size guide, GED-1006, gives information on how to save time and vital materials in getting reliable power to new production machinery by quickly installing electric power systems in new plants and plant extensions. Well illustrated with typical applications, the guide also includes advantages and specifications of equipment. General Electric Co.

19 Bus Protection — Linear coupler bus protection which meets three major power system requirements is described in 28-page Booklet B-3137. Information on the bus protection which minimizes major station damage, localizes power outages due to bus failures, protects the benefits of system interconnection, is detailed. Westinghouse Elec. & Mfg. Co.

20 Pivot Base Motors—Folder gives operating and construction data on Burke pivot base motors. All types of Burke motors and generators for V or flat belt, or short center drives can be mounted on Burke pivoted bases which automatically keep belt tension in proportion to the load, prevent belt slippage and allow higher belt speeds. Burke Electric Co.

FANS, PUMPS AND COMPRESSORS

21 Pump Bulletins—Complete details on Warren pumps are contained in Bulletins 228 and 229. Dimensional data, capacities, etc., on a complete line of centrifugal, liquor, duplex and single piston, plunger, vacuum units, will enable you to find just the pump to fit your particular needs. Warren Steam Pump Co.

22 Sanitary Pumps — New Bulletin 115 illustrates and describes Blackmer line of sanitary pumps which are widely used in food and beverage and processing plants. Contains specifications, charts and other helpful performance data. Blackmer Pump Co.

23 Victory Model Compressor—Compact V-design engine, lower foundation and housing costs, easier installation and servicing are among advantages claimed for the new G-MU victory model gas compressor built by Cooper-Bessemer. Fully described in attractive 8-page bulletin. Cooper-Bessemer.

24 Steam Pump Maintenance—Many valuable suggestions are given in new card "Pointers on Steam Pump Maintenance" which can be posted on wall for quick reference. Covers pump starting, lubrication of moving parts, care of stuffing boxes, etc. Worthington Pump & Mach. Corp.

25 Motor Blower Data—Bulletin 89 describes Niagara motor blowers available for pressures up to 4 in. s.p. and capacities from 880 to 42,600 c.f.m. Application data and pictures will be of special interest to boiler room and refrigeration engineers. Niagara Blower Company.

26 Pump Manual — The Stationary Instruction Manual is a 12-page bulletin, well illustrated and covering in detail the installation, operation and maintenance of small pumps. Text covers such points as installation, foundation bolts and grouting, alignment, suction lines, piping, relief valves, priming, starting, rotation, packing, dismantling and reassembly. Quimby Pump Co.

27 Compressor and Vacuum Pumps— New Bulletin C-5 describes a line of high efficiency rotary compressors and vacuum pumps. Capacities to 1800 c.f.m., actual free delivery, pressures to 125-lb.—vacuums to 29.90 in. (referred to 30-in. barometer). Fuller Company.

AIL THIS EASY-TO-USE CARD

28 **Centrifugal Compressors**—Catalog No. 386-2, describes Sturtevant Design 9 centrifugal compressors for application wherever blowers for smaller capacity work are required. Contains descriptive data, performance tables, dimension diagrams, installation photographs. Compressors are available in more than 200 sizes, with pressures from ½ to 3 lb., volumes up to 5500 c.f.m. Features include ability to deliver a wide range of volumes at constant pressures, exceptionally quiet operation, compact design, easy installation, and power savings. B. F. Sturtevant Co.

29 **Compressor Maintenance**—A conveniently arranged booklet on maintenance hints for 2-cycle gas engine driven compressors deals briefly with proper maintenance of units and troubles encountered by operators and gives methods for solving them. Also included is a list of do's and don'ts that should be useful to plant engineers and maintenance men. Clark Bros. Co., Inc.

INSTRUMENTS AND CONTROLS

30 **Resistance Thermometers**—Micromax resistance thermometers for measurement and control are described in Catalog N-33C which gives details of a method for measuring temperatures in air-conditioning systems, chemical processes, refrigerating systems, oil refineries, heating systems, etc. Included are photographs and drawings of typical industrial applications, tables of suggested ranges and specifications of the different types of instruments. Leeds & Northrup Co.

31 **Combustion Control**—"How To Safely Stretch Steaming Capacity" is the title of Bulletin 16 describing the Bailey combustion control system. Installation views, typical arrangements, application data are treated. This system is designed to increase boiler capacity, reduce boiler and furnace maintenance and save fuel. Bailey Meter Company.

32 **Handy CO_2 Analyzer**—Bulletin 338 describes simplified Firite "Orsat" analyzer. Held in hand while you make tests. A complete analysis in 40 seconds. Also tells about Fire Efficiency Finder—a calculator that converts CO_2 and stack temperature readings into heating efficiency percentages. Bacharach Industrial Instrument Co.

33 **Gages for Measuring Liquids**—Bulletin 1037 describes a complete line of liquid level gages for measuring liquids of all kinds whether light or heavy. Dial readings can be provided in feet, inches, gallons, pounds, liters or by any other desired increment. The Liquidometer Corp.

34 **Pressure Reducers and Controls**—Bulletin D-1 gives complete information and prices on the new improved Wizard pilot control, with throttling range adjustment from 1% to 75%—sensitive, accurate, reliable. Fisher Governor Co.

35 **Combustion Control**—In a 108-page textbook, principles and operation of Republic combustion control are discussed in detail. Installation reports on outstanding plants show how the controls are applied to all types of boiler equipment. Published as Data Book No. S-21 by Republic Flow Meters Co.

36 **Control Instruments**—16-page Bulletin Z-6100 is a condensed catalog illustrating and describing the company's complete line of measuring and control instruments. Included are photographs and line drawings of all the instruments, as well as their dimensions and list prices. Wheelco Instruments Co.

37 **Flow Meters**—A new 56-page edition of Cochrane's complete flow meter line describes electric, mechanical, linameter (area), ring balance, liquid level and weir meters. Also covered is the new 2 pen electric flow recorder with ratio indicating pointer. Includes a discussion of flow metering benefits and complete listings of specifications and ranges. Cochrane Corp.

38 **Adjustable Water Gages**—Pictured in a new bulletin are various models of Ernst split-gland adjustable water gages. Water level is visible from below and no tools required to change a gage glass. Ernst Water Column & Gage Co.

39 **Hand Tachometer**—Bulletin 1710 describes the Jones Heavy Duty Hand Tachometer, an indicating instrument for measuring speed directly in r.p.m. and f.p.m. James G. Biddle Co.

40 **Fluid Meter**—Bulletin 52 describes design and application of Simplex MS meter for measuring flow of steam, water, air, gas, and other liquids. Contains table for computing meter capacities. Simplex Valve and Meter Co.

41 **Coal Scales**—Construction and operating advantages of Seco coal scales, in 200 and 400 lb. sizes, are described in new bulletin. Stock Engineering Co.

MECHANICAL TRANSMISSION

42 **Bearing Metal Handbook**—8-page bulletin describes various lead-base metals which have proved to be excellent substitutes for tin-base bearing metals. Also contains suggestions for best results in making and maintaining journal bearings, and a table of recommendations for selecting correct bearing metal for 135 different types of machinery. Magnolia Metal Co.

43 **V-Belt Drive Conservation**—"23 Ways to Conserve the Life of Your Multiple V-Belt Drives" is the title of a primer written and illustrated in a simple comprehensive manner. The sole purpose of this book is to educate power users in the proper procedure of selection, installation and maintenance of their multiple V-belt drives, in order to obtain the maximum life of every V-belt. Multiple V-Belt Drive Assn.

44 **Reduction Drives**—American Retion Drives are described in revised Catalog R-42 which has just been issued. Included are photographs and drawings of typical applications and tables for selecting type of load, service correction factors, minimum diameters for driven pulleys, drive selection, dimensions and list prices. A valuable reference book for plant engineers. The American Pulley Co.

45 **Flexible Coupling**—8-page Bulletin No. 642 features Nicholson flexible coupling, its construction, functions, lubrication, strength, durability, and capacity. Also gives prices, dimensions and weights. W. H. Nicholson & Co.

46 **Belt Dressing**—"What's Your Toughest Belt Job?" is title of folder showing how Cling-Surface dressing is helping quarter turn, cross belts, short center, and other difficult belt installations save power and last longer. Includes offer for free sample. Cling-Surface Co.

47 **Wire Rope Manual**—Well illustrated 82-page book, "Know Your Ropes," provides a helpful handbook on the selection, application and usage of wire rope. Contains many diagrams for splicing and attaching; also ideas for conserving the strength and life of wire rope. A valuable reference book for engineers and maintenance men. Wickwire Spencer Steel Co.

48 **Handbook on V-Belts**—16-page pocket-size handbook entitled, "Plain Facts on Wartime Care of Rubber V-Belts," applies to all makes of V-belts and explains ways V-belt construction affects its maintenance, what determines life expectancy of a set of V-belts and what to do about worn sheaves. Allis-Chalmers Mfg. Co., Texrope Div.

This card should be filled in completely in order to secure the literature you request. Please indicate only the bulletins you particularly desire.

PIPING, VALVES AND FITTINGS

49 Pipe Outlets—16-page Bulletin WT31 illustrates and describes WeldOlets, ThredOlets and Socket-End WeldOlets, giving applications for which these three different types of fittings are suitable. All are designed for making the strongest possible right-angle, welded branch pipe outlet in the least time and at the lowest cost. Included in the bulletin are stock sizes, dimensions, weights and list prices. Bonney Forge & Tool Works.

50 Valve Hookups—"Good Valve Practice" is a comprehensive presentation of the design, performance and application of Jenkins bronze, iron and steel valves for steam, air, oil, water, gas, chemicals, solvents and other fluids and for pressures from 125 to 600 lb. Shows several types of power hookups, and demonstrates how to select valves for various requirements. Jenkins Bros.

51 Welding Fitting Data Book—New technical studies and engineering data will be found in this new Data Book 111. 232 pages of up-to-date essential data on the design of welded piping systems and the use of welding fittings are given in this most helpful book. Tube Turns, Inc.

52 Control Valves—Useful 96-page spiral-bound catalog presents some of company's various types of automatic control valves, designed for steam and water service. Operating sequence, construction, cushioning and arrangement of types listed. Golden-Anderson Valve Specialty Co.

53 Pipe Unions—Folder points out the many advantages of Dart unions. Bronze-to-bronze ball joints insure long life and tight joints. Because of precision in manufacture and design, these unions can be disconnected and reinstalled many times without loss of efficiency. E. M. Dart Mfg. Co.

54 Valves—New 168-page valve catalog No. 42 has just been issued. This catalog describes all types of valves and valve fittings, and gives helpful illustrations, tables of dimensions and list prices of all types. The Fairbanks Co.

55 Piping—4-page folder, Form No. 1871, entitled "A Scientific Approach to Piping Problems," describes two books; one on Flex-Anal Charts (a 100-page treatise on design of piping for flexibility) and the other Hanger Bulletin No. 1863. Included in the folder is a typical piping layout from superheater to turbine which shows an economical and modern layout of piping for any pressure and temperature condition. Power Piping Division, Blaw-Knox Company.

56 Silent Check Valves—Catalog No. 140 covers construction and advantages of Williams-Hager silent check valves for pump lines. Also illustrates pump valves, pump governors, traps, water columns and other specialties. The Williams Gauge Co.

57 Flexible Piping—Bulletin 71 furnishes money-saving data on Penflex, all-metal flexible piping for Diesel installations, exhaust pipes, air intakes and supply lines. Pennsylvania Flexible Metallic Tubing Co.

(Continued on Page 128)

★ Simple
★ Rugged
★ Reliable
★ Made in U. S. A.

. . . the JONES heavy duty HAND TACHOMETER

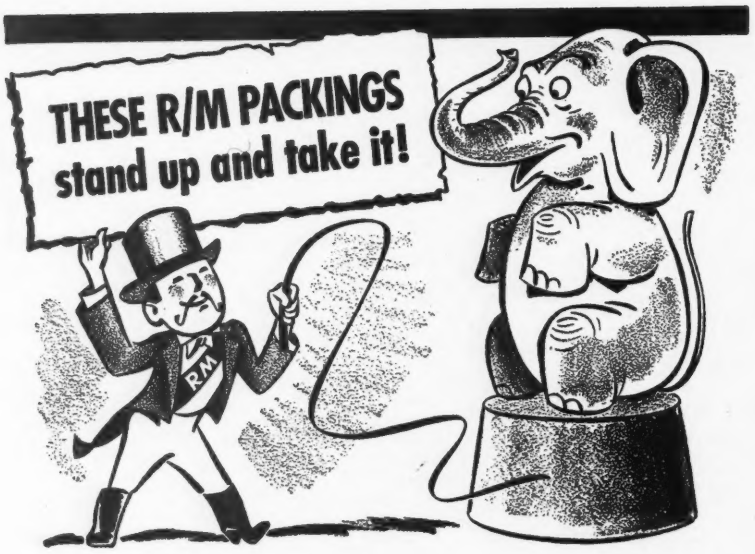
Here is a rugged American-built Hand Tachometer . . . available for delivery, in accordance with your priority rating.

We suggest the Jones Heavy Duty Hand Tachometer for indicating rpm and surface speeds of all types of machinery in which the moving parts are readily accessible.* It is built to "stand the gaff" and maintain accuracy in hard, everyday service. Single and triple range models up to 12,000 rpm. Instruments are furnished complete with carrying case, including extra tips. Rubber-tired wheel for measuring surface speeds available at slight additional cost.

*Where moving parts are not readily accessible, as in turbines, centrifugal pumps and other totally enclosed machines, and also for measuring vibrations per minute, we recommend our Frahm Vibrating-Reed Tachometers. Ask for Bulletin 1590-PE.

Write for new descriptive Bulletin 1710-PE

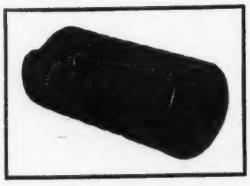
James G. Biddle Co.
1211-13 ARCH STREET *Electrical and Scientific Instruments* PHILADELPHIA, PA.

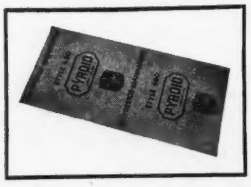


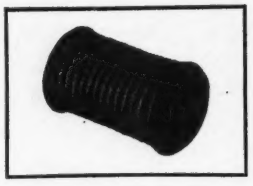
Tough as an elephant's hide, R/M packings stand up under today's higher pressures in steam lines, oil lines, fuel lines, and air lines. They never forget that their job is *transmission* of power and not *emission* through leaks or blowouts.

In R/M laboratories, engineers bend over formulas and testing-apparatus, then apply their new-found knowledge in the field, to improve the performance of R/M packings wherever and whenever possible. R/M packings are helping to win the battle of production!

Do you have a copy of the R/M catalog? It's keyed for applications, illustrated, and indexed as to materials and types. Get a copy from your R/M distributor, or write us direct.







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Makers of Packings for Every Industrial Use

58 Steam Traps — 16-page Bulletin T-1737 outlines Yarway impulse steam traps with operating principles, construction details, typical installations, additional applications, installation and operating suggestions, capacities and prices, weights and dimensions. Yarnall-Waring Co.

59 Wrought Iron Pipe—Four large wall-type instruction charts and four booklets are available covering pipe threading, pipe bending, plate bending and flame cutting and welding. They have been prepared for use in an industrial refresher course for pipe fitters, plumbers, welders and all other metal workers interested in saving metal for the war effort. A. M. Byers Co.

60 Steam Specialties — New catalog contains descriptive bulletins on steam traps and drainage equipment—vacuum and lifting traps—pressure regulating valves—separators and other Strong steam specialties. Contains capacity tables, piping hookups, operating hints and other data of value to plant engineers and maintenance men. The Strong, Carlisle & Hammond Co.

61 Coal Valves—Beaumont coal valves, particularly suited for installation in chutes feeding to pulverizers or stokers, are described in new bulletin. Valve bodies and gates are of cast iron to prevent corrosion or warping. Beaumont Birch Co.

62 Hints on Pipe Joining—New 16-page booklet "Here's How You Can Join Pipe Without Threading" explains how use of the Dresser no-thread fitting saves time and money in pipe work. Many illustrations show how these fittings are applied on water pumps, boiler controls, hot water lines, oil and gas lines, etc. Dresser Manufacturing Co.

63 Fire Protection Valves — Bulletin E-52 B, 4 pages, covers weight-operated Everlasting valves with pendulum stop for fire protection service. Illustrations show both opening and closing types with full specifications. Everlasting Valve Co.

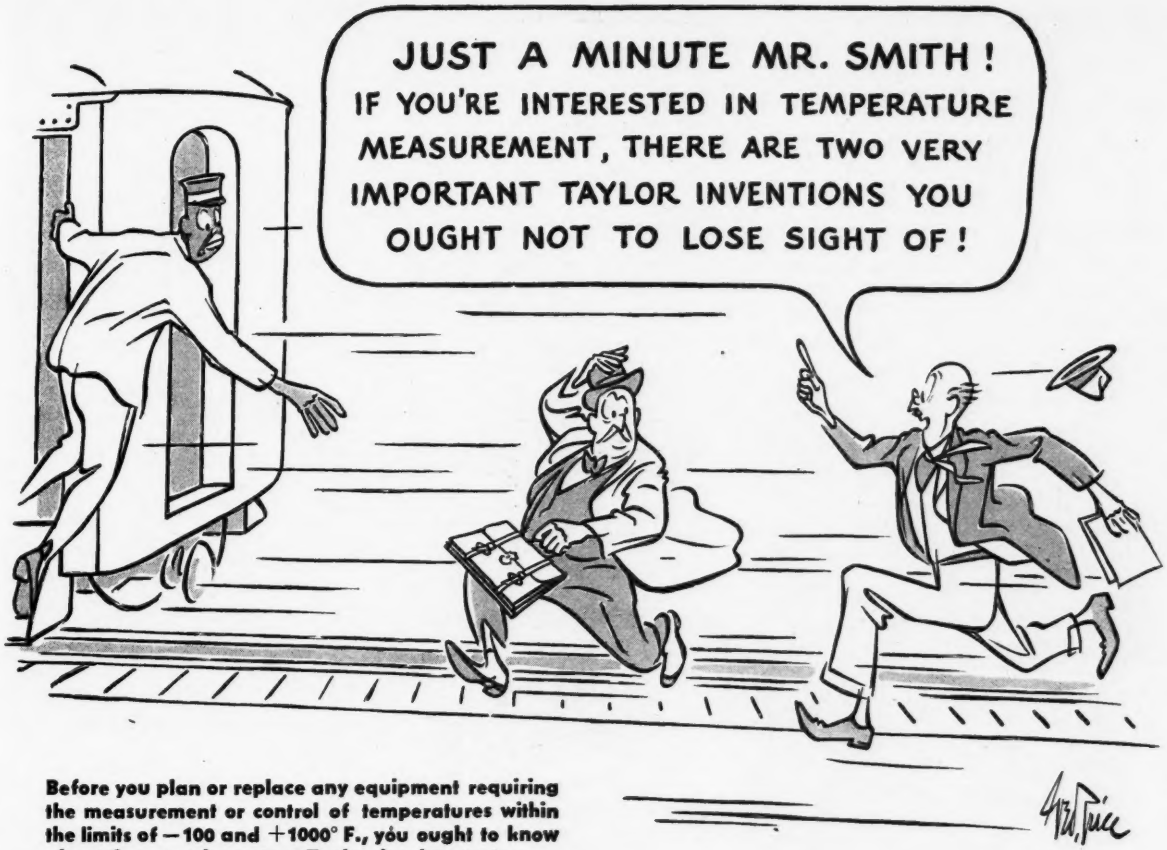
64 Valve Repair Pointers — 6-page "how to do it" Bulletin No. 5 gives timely hints on repairing and servicing gate and globe valves. Information on regrinding and renewing discs and seats with illustrations is included. Extremely useful in shop or classroom. Crane Co.

65 Adjustable Pipe Hangers—Catalog 8 provides complete engineering data, illustrations, and dimension tables on adjustable-after-erection pipe hangers, supports and brackets. Book shows how to speed up wartime piping schedules. Grinnell Co., Inc.

66 Silent Check Valves—Bulletin explains how Combination silent check valves end water hammer in boiler feed lines, foot valves, house pumps, etc. Also gives pressure ranges, dimensions, prices and other helpful data. Combination Pump Valve Co.

67 Metal Hose Handbook — Bulletin No. H-201 gives complete information about Eclipse seamless flexible metal hose, widely used for handling alcohol, grease, hot liquids, oil, steam and other non-solids, where high temperature and pressures prevail, and

(Continued on Page 130)


JUST A MINUTE MR. SMITH!
IF YOU'RE INTERESTED IN TEMPERATURE MEASUREMENT, THERE ARE TWO VERY IMPORTANT TAYLOR INVENTIONS YOU OUGHT NOT TO LOSE SIGHT OF!

Before you plan or replace any equipment requiring the measurement or control of temperatures within the limits of −100 and +1000° F., you ought to know about these two important Taylor developments:

1. Mercury tubing that can't tell a lie! Imagine being able to have all the advantages of a mercury-actuated recording thermometer—on an application requiring long lengths of connecting tubing! It's long been an established fact with Taylor Accuratus Tubing. This precision-bore tubing, a Taylor invention, has a special alloy wire inside, with a coefficient of expansion so related to the tubing and the mercury that any variations in ambient temperatures along the way are counteracted on the spot. The result is *accurate* temperature recordings.

2. Accurate temperatures several times faster! Where a separable well is required to protect the temperature-sensitive bulb from erosion or corrosion (or to permit removal of the bulb without disturbing the contents of the equipment) there always used to be a considerable time lag in transmitting temperature changes to the bulb. But that was before Taylor "Thermospeed" came along. With Taylor Thermospeed Separable Well construction, response is several times faster than the average separable well tube system, with minimum bulb conduction error.

CALL YOUR TAYLOR FIELD ENGINEER. These are only two of the many "plus-values" which have given Taylor its reputation for leadership in the temperature field. If you need indicating, recording or controlling temperature instruments, your Taylor Field Engineer will determine whether a mercury, vapor or gas-actuated system is best for your particular requirements. And from a wide variety of bulb and well constructions and connecting tubings at his command, he will specify the other details which assure the accuracy, responsiveness, and long life characteristic of Taylor Instruments. Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada. *Instruments for indicating, recording, and controlling temperature, pressure, flow, humidity, and liquid level.*

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where flexing and vibration are encountered. A helpful book for engineers, designers and specification men. Eclipse Aviation (Metal Hose Department) Division of Bendix Aviation Corp.

68 Steel Fittings Handbook — New Bulletin A-3 offers 44 pages of useful information on forged steel fittings. Includes 100 illustrations, 78 drawings, many basic engineering tables, charts and data. The Watson-Stillman Co.

69 Double Seal Connections—Catalog Section 3 outlines easy steps for joining copper pipe with Hays double seal connections. This method combines a 45 deg. with a 90 deg. seat for double tightness. Also describes tees, unions and other fittings; contains useful engineering and performance data. Hays Mfg. Co.

WATER TREATMENT

70 Boiler Water Problems—"Technical Water Conditioning System for Boilers" is the title of a new 12-page bulletin covering boiler water problems and their treatment. Includes chart showing money lost with boiler scale of varying thicknesses. Water Treatment Company of America.

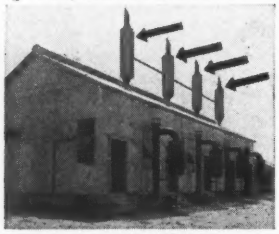
71 Chemical Feeders — Bulletin No. 122 illustrates and describes Proportioneers chemical treating and feeding systems for power plants. It includes the handling of phosphates, sulphites, sulphates, sulphuric acid, etc. A valuable reference bulletin for engineers on problems of scale, pitting and corrosion, carry-over. Proportioneers, Inc.

Diesel Power for your plant

—without exhaust noise

is on the way!

New municipal plant at Brooklyn, Iowa, with Snubber-equipped engines.



Four Snubbers at Shell Oil Company's East Cromwell, Okla., plant

If that Diesel engine you want is hard to get, be patient. There are a couple of dictators holding up shipment.

When you do get it, be sure it's equipped with a Burgess Exhaust Snubber. Your neighbors will sleep better, and you'll appreciate having a quiet exhaust without any sacrifice of engine efficiency.

You can't beat a Burgess Snubber for efficient elimination of exhaust noise. Operating on the Burgess snubbing principle, it *prevents*—not muffles—the noise. So don't ask for a "muffler"—specify a Snubber. Hundreds of installations in hotels, hospitals, office buildings, municipal plants, and other critical locations are proof of its success. Burgess Battery Company, Acoustic Division, 2823-K W. Roscoe St., Chicago.

Originators of Snubbing Principle for Quieting Diesel Exhausts

BURGESS
DIESEL EXHAUST
SNUBBERS

72 Zeolite Softener — Elgin double check zeolite water softener equipment is illustrated and described in a new 4-page folder entitled Bulletin No. 605. The design is said to increase softening efficiency and increase capacity, making it possible to use more Zeolite in a given softener without loss. Elgin Softener Corp.

73 Condensate Corrosion Control — Case history data on condensate corrosion control by the Haering Process of direct introduction of chemicals into the steam has been released in a 6-page pamphlet which tells the story of a severe condensate corrosion condition in the Cook County Nurses Home where double extra heavy wrought iron piping failed in 30 da. service. D. W. Haering & Co., Inc.

74 Technical Paper on Water Analysis—A convenient and accurate method of calcium determination for routine plant control has been developed by W. H. and L. D. Betz, Chemical Engineers and Consultants. Details of this new method, which is simpler and quicker than the conventional gravimetric calcium analysis, are given in the Betz Technical Paper No. 81, entitled "Determination of Calcium in the Presence of Magnesium by Standard Soap Solution." Complimentary copies will be furnished on request.

75 Feedwater Treatment — 4-page folder introduces Tanalginate, new protective and reactive colloidal material for conditioning boiler feedwater. Product is used in conjunction with such inorganic chemicals as phosphates or alkali. The Bird-Archer Co.

76 Preventing Silica Scale—Helpful booklet describes Permutit's Magde-Sil process to prevent silica scale in boiler tubes, superheaters and turbines. Process is adaptable to hot or cold lime soda softeners; uses low-cost reagents. The Permutit Co.

MISCELLANEOUS

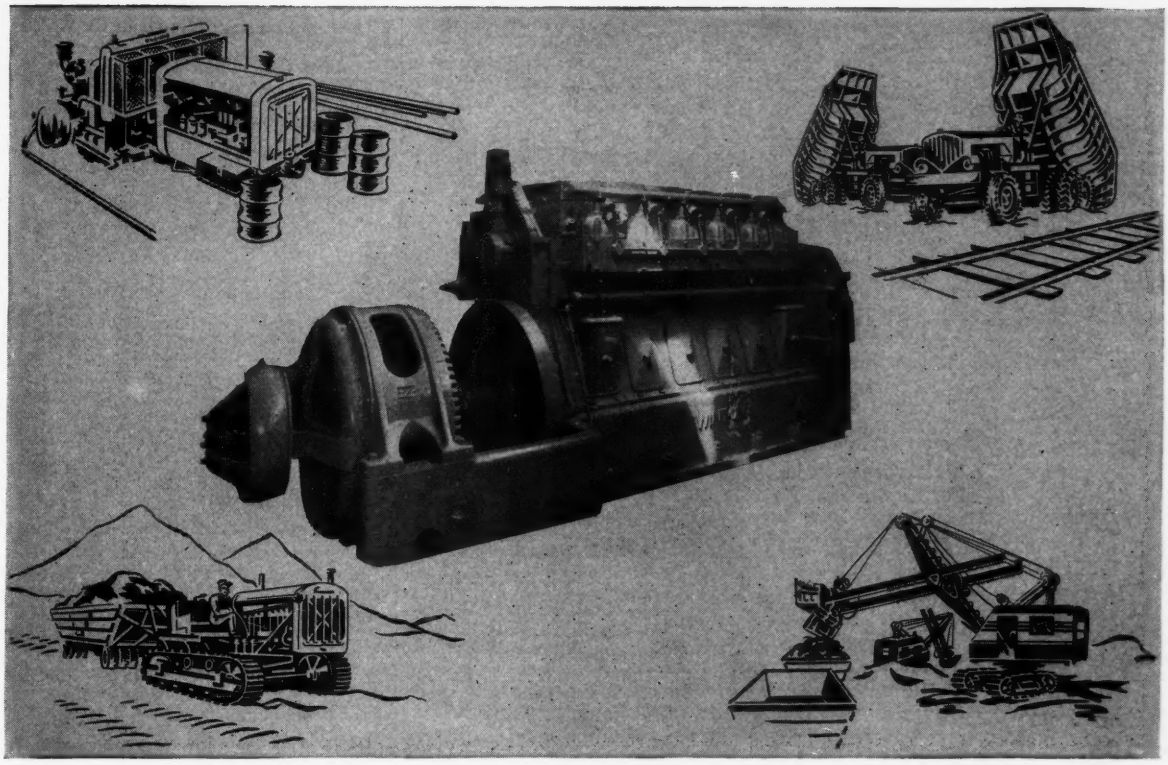
77 Refractory Concrete — 24-page book features characteristics of Lumnite, methods of making refractory concrete, heat-resistant concrete and refractory-insulating concrete. Book contains many photographs and tables. Atlas Lumnite Cement Co.

78 Engineering Standards—The newest list of American Standards for 1942 has recently been announced. Contains 550 American Standards, should serve as useful reference to the engineering and purchasing departments of many manufacturing firms. Included are definitions of technical terms, specifications for metals and other materials, methods of test for the finished product, dimensions, etc. American Standards Assn.

79 Power Check Chart — "National Power-Recovery Plan" is the title of a booklet describing a plan to stimulate the reduction of industrial power losses, whether you purchase your power or generate it. Containing a series of estimators, each relating to a certain phase of power service, you are enabled to report every possible power leak which can be corrected in various departments. L. H. Gilmer Co.

80 Direct Fired Heaters—New Bulletin 506 covers Dravo direct fired heaters. Many charts and tables deal with savings in fuel, manpower and critical materials. Dravo Corp.

(Continued on Page 132)



NEW ENGINE OF WAR

Today your Diesel is a fighting machine . . . a mighty engine of war on the production front. To meet wartime quotas, your Diesel must drive longer and harder than ever before. For war production demands all-out, non-stop performance.

Never before have such heavy demands been put upon your Diesel. And never was it more vital to keep it rolling in active service—to safeguard it against breakdown *with the right lubrication!*

The stakes are too high, the times too critical, to muddle along with ordinary, makeshift lubrication. For the plain fact is that *continuous, efficient operation demands a lubrication plan designed for your particular job!*

That's where a Cities Service lubrication engineer can be of great help to you. He knows what you're up against, and he has the necessary "know-how" and special instruments to tackle the job scientifically.

Why not have him go over your lubrication problems? There's no charge for this consultation service. Simply phone or write the Cities Service office nearest you and ask that an engineer call. An informative booklet, "Diesel Engine Lubrication," is available to the personnel of Diesel oil users. Fill out coupon or write us on your stationery for a copy.

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Quick answers to pumping and piping problems. For Engineers. Ask for Bulletin 302.

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A 24 page catalog illustrating types of hand and power pumps for various industrial uses. Ask for Bulletin No. 130.

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Covering many specific liquid-handling problems. Issued frequently by the Blackmer Engineering staff. May we add your name to the mailing list?

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The 10 commandments of rotary pump maintenance. Card punched to hang near pumps. Ask for SER-1.

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Buy WAR BONDS

Qualify for the 10 Per Cent Club by investing 10% of your earnings in War Bonds for Victory. Show Uncle Sam you're glad you're an American and are willing to *invest* your money to stay one!

81 Free Repair Handbook — A 40-page guide to the use of Smooth-On cements contains 170 diagrams and instructions for making lasting and economical repairs to plant equipment and machinery, pipe lines, fixtures, etc. Smooth-On Mfg. Co.

82 Graphite Lubrication—A 16-page booklet titled "Plant Engineer's Handbook" deals with the application of Cograph, a colloidal graphite in making lubricants more effective. Included in the booklet is an alphabetical index listing machinery parts needing lubrication, with a Cograph remedy. Nassau Laboratories.

83 Alloy Steel Chart—Newly printed is letter-size chart showing analyses, physical characteristics and applications of 19 different stainless steel, monel and nickel alloys. It contains a handy cross reference of designations and type numbers of the Alloy Casting Institute, the American Iron and Steel Institute, American Society for Testing Materials, Society of Automotive Engineers, U. S. Navy, and others. The Cooper Alloy Foundry Co.

84 Industrial Insulations—Form IN-55A, 32 pages, gives recommended thicknesses of insulation material for use from 400 deg. below zero F. to 3000 deg. above zero F.—drawings, recommendations for power plants and for eight special industries. A valuable reference book for plant engineers. Johns-Manville.

85 Power Saving Turbines—Eight-page Bulletin S-116 illustrates and describes application, construction, savings effected and advantages of the Terry solid wheel turbine. The Terry Steam Turbine Co.

86 Sludge Solvent and Carbon Remover — Literature describes a liquid compound for keeping oil systems operating at maximum efficiency by removing the hard carbon formed on burners and preheaters when fuel oil is burned, and by dissolving sludge in oil tanks. Maxfal Chemical Co.

87 Floor Repairs—A new tough floor patch or overlay "Instant-Use" for broken, rutted floors can be trucked over immediately following installation. Bonds to feather edge. Can be used over concrete or wood. Write for explanatory folder. Flexrock Co.

88 Lubrication Handbook — "Diesel Engine Lubrication" is the title of a 16-page booklet giving information on characteristics of Cities Service oils for Diesel engine use. Stresses importance of correct lubrication from both a maintenance and operating standpoint. Recommendation chart shows proper grades of principal brands of this company's Diesel engine oils, listed in accordance with engine builder's specifications. Cities Service Oil Co.

89 Electric Vibrators—Folder shows typical installations of electric vibrators for keeping materials flowing freely through hoppers, chutes; increasing weight contents, and eliminating air pockets. Syntron Co.

90 Lubrication Chart—Newly issued bulletin describes Albany lubricants for industry; includes handy recommendation chart for lubricating compressors, conveyors, pumps, shafting, steam engines, turbines and other equipment. Albany Grease Co., Division of Adam Cook's Sons, Inc.

(Continued on Page 134)

How to calculate Rate of Heat Flow through Metallic Walls

As a result of work done by INCO Technical Service, a new booklet, "Heat Transfer through Metallic Walls," has recently been printed.

It explains in detail how to calculate heat transfer, and covers conductance values of film, scale, and condensing vapor film. It also includes tables on thermal conductivity of various metals, conductance ranges for metallic walls and films and other phases of the subject.

A valuable section of "Heat Transfer through Metallic Walls" consists of charts on heat transfer co-efficients for 11 different metals:

Copper	Lead
Aluminum (25)	Cupro Nickel (70-30)
Red Brass (85-15)	Monel
Admiralty Brass	Inconel
Mild Steel (SAE 1020)	Stainless Steel (Type 430)
Nickel	Stainless Steel (Types 304, 316, 321)

In addition to the information contained in this bulletin, INCO Technical Service will gladly furnish personal assistance in the solution of specific heat transfer problems.

For copies of "Heat Transfer through Metallic Walls" please mail the coupon below.

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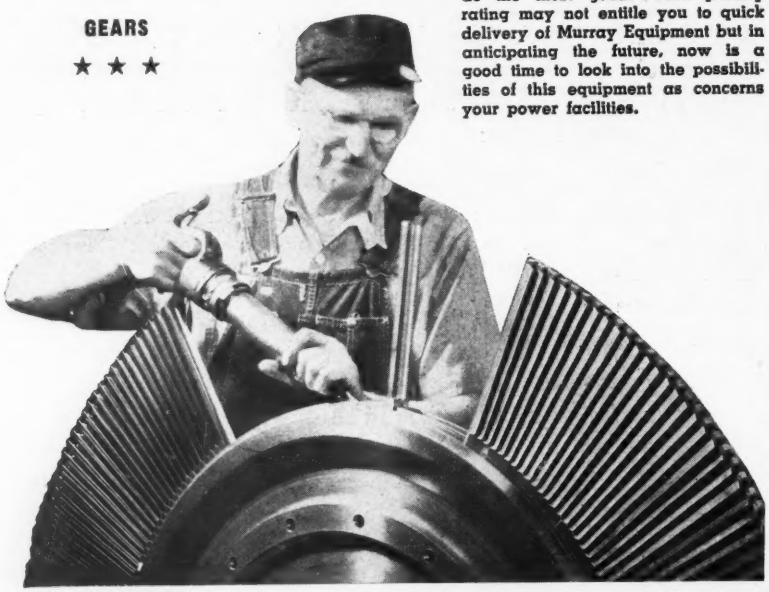
Power always has been and always will be the basis of production. Murray Equipment is closely linked with the production of power. Therefore, at the start, our engineering ability and production facilities were centered on designing and building power equipment that would make definite contributions to smooth production and to day-by-day economy. Murray Equipment that was in service at the beginning of industry's victory production efforts were readily capable of meeting stepped up requirements.

Today we are filling Victory orders as quickly as possible—getting Murray Equipment out where it will do the most good. Your priority rating may not entitle you to quick delivery of Murray Equipment but in anticipating the future, now is a good time to look into the possibilities of this equipment as concerns your power facilities.



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(1) Speed governmental accomplishment in the drive for victory . . . (2) Expedite conversion of industry to wartime production . . . (3) Ease the shock of war on civilian population and national economy . . . (4) Divert demand from scarce articles to those more plentiful . . . (5) Explain business to the public . . . (6) Condition markets for postwar developments.—G. D. Crain, Jr., Publisher of "Industrial Marketing"

91 Rubber Conservation — New 48-page rubber-conservation manual discusses ways and means of making the present supply of rubber goods for civilian use last longer. Among the products discussed are: hose, transmission, conveyor and elevator belts, mechanical packings, electrical tapes, wires and cables. U. S. Rubber Co.

92 Pulley Type Separators—Bulletin No. 602 pictures and describes the Memco magnetic pulley type separators for removing iron from coal and other materials. Contains tables of weights, capacities and dimensions. Magnetic Engineering & Mfg. Co.

93 Plastic Insulation—Attractive bulletin describes money-saving applications of Wyo-lite plastic insulation on air ducts, boilers, hot water tanks, steam cylinders, etc. Many helpful charts on figuring heat losses. Wyo-lite Insulating Products Div. of The Wyodak Chemical Co.

94 Packings—Sixty-four page catalog illustrates and describes a comprehensive line of packings, gaskets, gasket and lubricating pastes, etc. Reference to text and recommendation tables will enable you to select a satisfactory material for any packing job. The Garlock Packing Co.

95 Heat Resisting Coatings—A bulletin describing heat resisting coatings for metal that give continued protection to surfaces of metals from ordinary conditions to temperatures to 1800 deg. F. without discoloring, peeling or cracking. The coatings are said to be unaffected by fumes of sulphur dioxide, carbon dioxide, acetic acid or chlorine in the presence of moisture. Thurmalox Co.

96 Unit Heaters — Bulletin 142, 8 pages, features style I/S horizontal-delivery unit heaters which retain all performance and structural features that characterize the copper-condenser model. Also contains tables of constants for steam and hot water. Modine Mfg. Co.

97 Diesel Engine Lubricating Oil—Data describes RPM Delo lubricating oil for use in Diesels of any make and any size. Standard Oil Co. of California.

98 Packing Applications — Recent R/M catalog contains helpful tables showing recommended types of packing for lines handling steam, oil, air and fuel. A valuable reference book for all maintenance engineers. Raybestos-Manhattan, Inc.

99 Coal Weigh Larries—How Bartlett-Snow weigh larries keep accurate records of coal fed to each boiler, prevent coal segregation, save on bunker costs, is told in engineering Bulletin No. 83. Also describes skip hoists and other equipment. The C. O. Bartlett & Snow Co.

100 Refractory Selector—Handy bulletin contains selector chart for choosing proper refractory for furnace doors, arches, baffles, ash pits, etc. Also provides color scale for temperature and other working data useful to boiler room and maintenance engineers. The Wahl Refractory Products Co.

101 Steam Hook-ups—New 42-page book has engineering data on selecting and installing steam traps, temperature regulators, and heating system specialties with 75 hook-up sketches of correct steam piping for all types of industrial and heating equipment. Sarco Co., Inc.

Tight Tube Joints

EASILY—QUICKLY—ON FIRST ROLLING

Seldom is it necessary to re-roll a "weeping" joint when Republic ELECTRUNITE Boiler Tubes are used. Joints are tight after one easy, quick roller expanding operation.

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ELECTRUNITE Tubes—because they are cold formed from flat rolled steel and electric resistance welded—are *consistently uniform* in diameter, wall thickness, concentricity and ductility.

They slide easily through holes in tube sheets and drums. The expanding tool rolls the wall evenly and rapidly to a sound joint. Beading over and welding are just as easy and positive.

Are you taking advantage of the easy-to-install features of ELECTRUNITE in speeding up construction or retubing of vital heat transfer equipment? Users have reported up to 30% savings in installation cost. That also means savings in time.

Write us for the complete story. And if you expect the need of tubes in the near future, give us or your nearest ELECTRUNITE Distributor full information on your requirements at the earliest possible date. That will save time, too.

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Keep These Vital Tools in Perfect Condition

Suppose an emergency required you to open one of your boilers, condensers or other tubular units today. Would you be able to take advantage of this condition by descaling tubes while the unit is down?

How long is it since you looked over your tube cleaners? Why not do it now, while you think of it? They may need adjustment, repair or parts replacement. You'll have to use your tube cleaners sooner or later, perhaps sooner than you expect. So why risk tieing up the unit on account of tube cleaners? Get them ready for immediate action now.

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It Tells How . . . Where . . . Why . . .

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Reading the advertising messages that appear in POWER PLANT ENGINEERING is a profitable practice. It helps keep you posted on newest types of power equipment; tells how and where and why it can improve operating efficiency, conserve manpower, simplify maintenance.

NEW EQUIPMENT

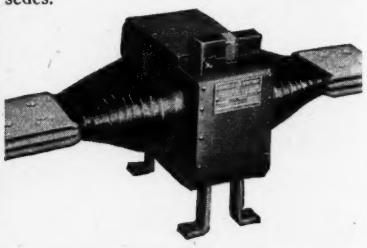
(Continued from Page 122)

ard motor and the output shaft can be run at motor speed and is flexible enough to be applied to any type of machine within its power range.

An interesting feature of this drive is its mechanical, positive belt-tensioning device which automatically compensates for increased arc of belt contact which results from changing from low to high speeds. In this tensioning device no springs are required. A further feature is the fact that the drive need not be dismantled to change belts. According to the manufacturer other sizes are now being developed for 1 to 3 hp., 3 to 5 hp., 5 to 7¼ hp., and 7½ hp. to 10 hp.

Indoor Current Transformer

A NEW indoor current transformer, Type JK-9, is announced by the General Electric Co., Schenectady, N. Y. This transformer is said to have better accuracy, higher insulation, and is smaller in size than the Type KC-51 it supersedes.



The high accuracy of this transformer makes it ideal for relay applications, particularly differential relaying, as well as for metering service. During overcurrent conditions, with a burden Z, all ratings will be well within 8 per cent of the true ratio at 20 times normal current. The metering-service accuracy classification of the various ratings is: 1000 and 1200 amp., ¼X, ¼Y, and ½Z; 1500 to 4000 amp., ¼X, ¼Y, and ¼Z. It is also rated 15 kv., 1000 to 4000 amp.

The impulse strength of these units meets the test requirements for 95 kv., full wave on both insulation and flashover (ASA standard for 15-kv. instrument transformer).

The JK-9 is 6 in. shorter than the superseded design therefore requires less mounting space.

Filter Recharge

A NEW recharge for their absorbent type fuel and lubricating oil filter has been announced by Wm. W. Nugent & Co., 410 N. Hermitage Ave., Chicago, Ill.

The recharge is inserted in the filter cage instead of hand packing loose waste. When it becomes dirty, the cage is removed from the filter shell, turned upside down and the recharge slides out and is thrown away.

The recharge is made of special absorbent cotton material and is said to absorb four times its own weight of water, dirt and other impurities. Acidity in lubricating oil is also reduced, but it will not remove additives that are scientifically embodied in the oils at the refinery. The absorbent material is packed and supported in the recharge to produce even and controlled filtering.

DON'T DO THIS TO YOUR VALVES!

Don't use a long lever and strong pull on any screwed joint, either. Avoid twisting the valve, by using a short lever and a few hammer taps.

At no time permit anyone to use a wrench on the valve hex farther from the joint. Valve bodies are strong but they are not designed to withstand that sort of strain. A twisted body—and a valve that will not operate—may very well be the result. . . . Remember, high pressure war production and allocation of critical metals have combined to make it difficult to get new valves. Guard those that you now have.

READING-PRATT & CADY

MANUFACTURERS OF

CAST STEEL VALVES • BRASS AND IRON VALVES • *D'ESTE* ENGINEERING SPECIALTIES

Reading, Pa., Atlanta, Boston, Chicago, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco

A Division of AMERICAN CHAIN & CABLE COMPANY, INC. *Bridgeport, Conn.*

Safer Boiler Operation
Easier Maintenance with ERNST FITTINGS

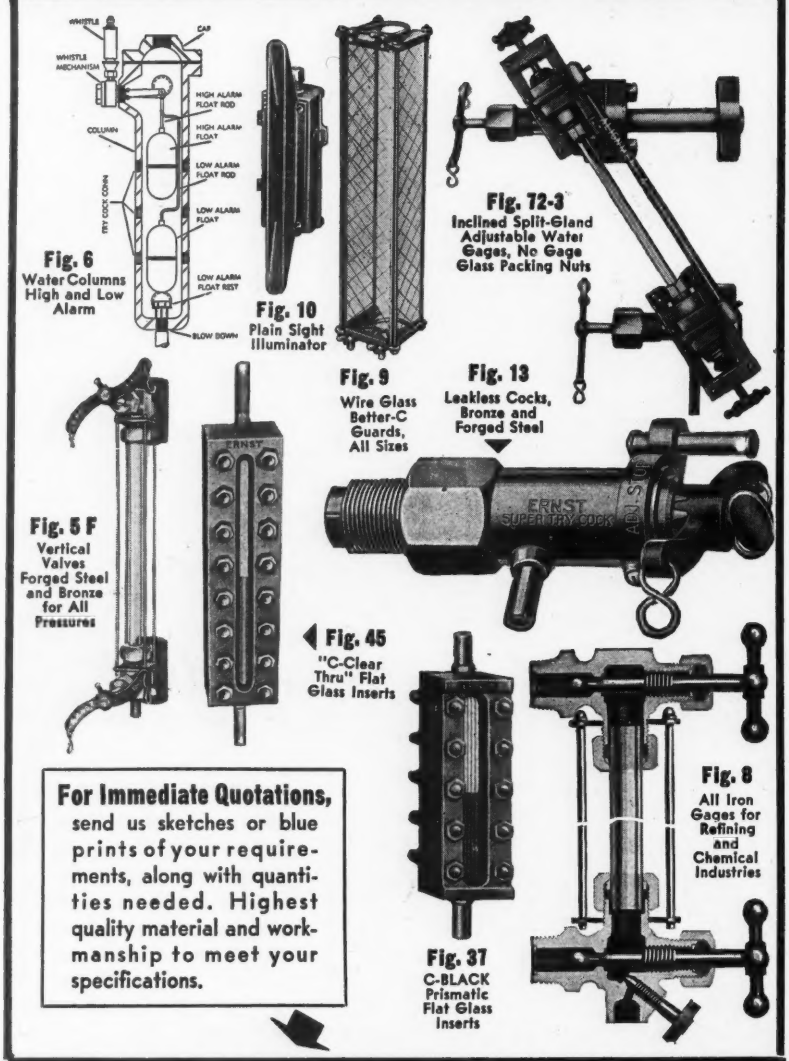


Fig. 6 Water Columns High and Low Alarm

Fig. 10 Plain Sight Illuminator

Fig. 72-3 Inclined Split-Gland Adjustable Water Gages, No Gage Glass Packing Nuts

Fig. 9 Wire Glass Better-C Guards, All Sizes

Fig. 13 Leakless Cocks, Bronze and Forged Steel

Fig. 5 F Vertical Valves Forged Steel and Bronze for All Pressures

Fig. 45 "C-Clear Thru" Flat Glass Inserts

Fig. 8 All Iron Gages for Refining and Chemical Industries

Fig. 37 C-BLACK Prismatic Flat Glass Inserts

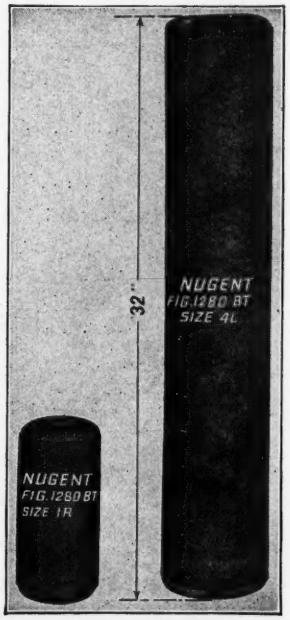
For Immediate Quotations, send us sketches or blue prints of your requirements, along with quantities needed. Highest quality material and workmanship to meet your specifications.

ERNST WATER COLUMN & GAGE CO.
LIVINGSTON, N. J. Phone: Livingston 6-0276

To Simplify Wartime Buying . . . .

★ Listed each month in the Where-To-Buy section of this magazine are more than 270 different products used in operating and maintaining power plants. . . . Turn to this conveniently classified listing of equipment and manufacturers' names to simplify and speed up your wartime buying. ★

There is no channeling or capillating. The outside surface contacted by the dirty, incoming oil is larger than the final inside filtering surface and is effectively graduated between these points, so that the larger dirt particles are removed first by the larger area and the impalpable materials last by the denser filtering material.



Alcohol Fire Extinguisher

ALCOFOAM, manufactured by American-LaFrance-Foamite Corp., Elmira, N. Y., is a new foam developed to safeguard the vital and rapidly expanding alcohol industry against fire. Produced from Alcofoam powder, it is said to form a smothering blanket that snuffs out flames in alcohols, ketones, esters, ethers, and other such flammable liquids, including petroleum.

Poured into any single powder generator and carried through a water stream, Alcofoam powder generates a foam which floats on the lightest liquid surface. Applied at time of fire through fixed connections on storage tanks, or directed through hose and nozzle, it

WeldELLS

It's the difference between RIGHT and WRONG —*this "selective" reinforcement*

BOTH mathematical calculations and practical tests* prove that the bursting stresses in an elbow are greatest at the crotch or inner wall. That's why a special process is employed in producing WeldELLS which provides extra metal in this region of greatest stress as pointed out above. It is the nearest possible approach to the "One Hoss Shay" ideal of absolutely uniform strength throughout.

And it's also one more example of the length to which we have gone in producing WeldELLS to follow sound engineering considerations—considerations which mark the difference between right and nearly right.

An extra value, this—and opposite are listed other extra-value features that are combined in no other fittings for pipe welding. Yet: WeldELLS cost no more!

WeldELLS have *everything*—

No other fittings for pipe welding combine the features found in WeldELL. In addition to that described, they include:

▶ **Seamless**—greater strength and uniformity.

▶ **Tangents**—keep weld away from zone of highest stress—simplify lining up.

▶ **Precision quarter-marked end**—simplify layout and help insure accuracy.

▶ **Permanent and complete identification marking**—saves time and eliminates errors in shop and field.

▶ **Wall thickness never less than specification minimum**—assures full strength and long life.

▶ **Machine tool beveled ends**—provides best welding surface and accurate bevel and land.

▶ **The most complete line of Welding Fittings and Forged Steel Flanges in the world**—insures complete service and undivided responsibility.

* The amount by which stress is greater at the crotch in a fitting having uniform wall thickness depends only on its radius. Mathematical analysis (specifically the Lorenz formula) shows the stress at the crotch to be:

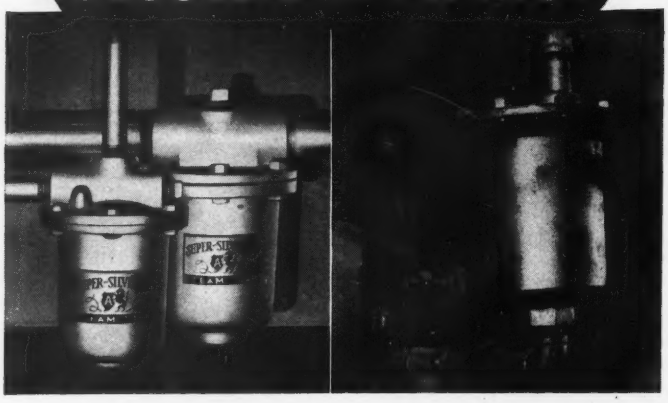
$$S = \frac{pr\,(2R - r)}{2t\,(R - r)}$$

Where S = Bursting stress, lbs. per sq. in.
p = Internal pressure, lbs. per sq. in.
r = ½ inside diameter of fitting (O.D. if Barlow's formula is desired).
t = Wall thickness in inches.
R = Center line radius of fitting, inches.

Numerous tests by the Research Division of Taylor Forge show the formula given above to be somewhat on the conservative side.

TAYLOR FORGE & PIPE WORKS, General Offices & Works: Chicago, P. O. Box 485
New York Office: 50 Church Street • Philadelphia Office: Broad Street Station Bldg.

Can war production wait on
OBSOLETE STEAM TRAP PIPING?



MODERN **OBSOLETE**

● War production cannot be held up for complicated obsolete steam trap piping. Time is invaluable. Installation of new traps, changes in trap location or trap inspection, must be done in the shortest possible time in order not to tie up steam-using equipment. This means using Anderson Super-Silvertop Steam Traps installed as an elbow or straight-in-line connection, thereby saving from 40 to 60 minutes' time per trap. Besides there's a saving of from 6 to 13 fittings per trap. More than that, Super-Silvertops can be inspected without disturbing pipe connections. Let us send you a copy of the book, "How To Select A Steam Trap."

THE V. D. ANDERSON COMPANY
1939 West 96th Street • Cleveland, Ohio

Super-Silvertop STEAM TRAPS

WHEN YOU WRITE TO ADVERTISERS

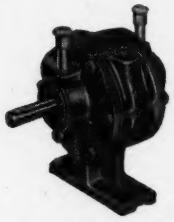
When writing advertisers for catalogs, descriptive bulletins or prices, please remember to say, "I saw your message in POWER PLANT ENGINEERING." Thus you'll do a good turn for the advertiser and for this publication. . . . . .

completely cuts off the supply of oxygen necessary to support combustion.

It is said to form an airtight, heat resisting, tenacious blanket made up of millions of minute, tough, durable bubbles containing carbon dioxide gas. It stays in place despite fire draft, preventing reignition or reflash. It coats and insulates any burning surface, liquid or solid, vertical or horizontal.

Rotary Air Motors

ANNOUNCEMENT has been made by Gast Mfg. Corp., Benton Harbor, Mich., that its rotary air motor is now available for new applications. This unit is especially suitable for locations where compressed air is available and where explosion-proof equipment is essential.



This motor offers the following desirable features: No reciprocating parts or springs, automatic take-up for wear, low maintenance, positive starting in any position and exceptional compactness for power developed.

Capacities range from 1/20 to 1 hp. and the motors are fitted with ball bearings with all parts accurately ground. Self-adjusting shaft seals are used in place of packing.

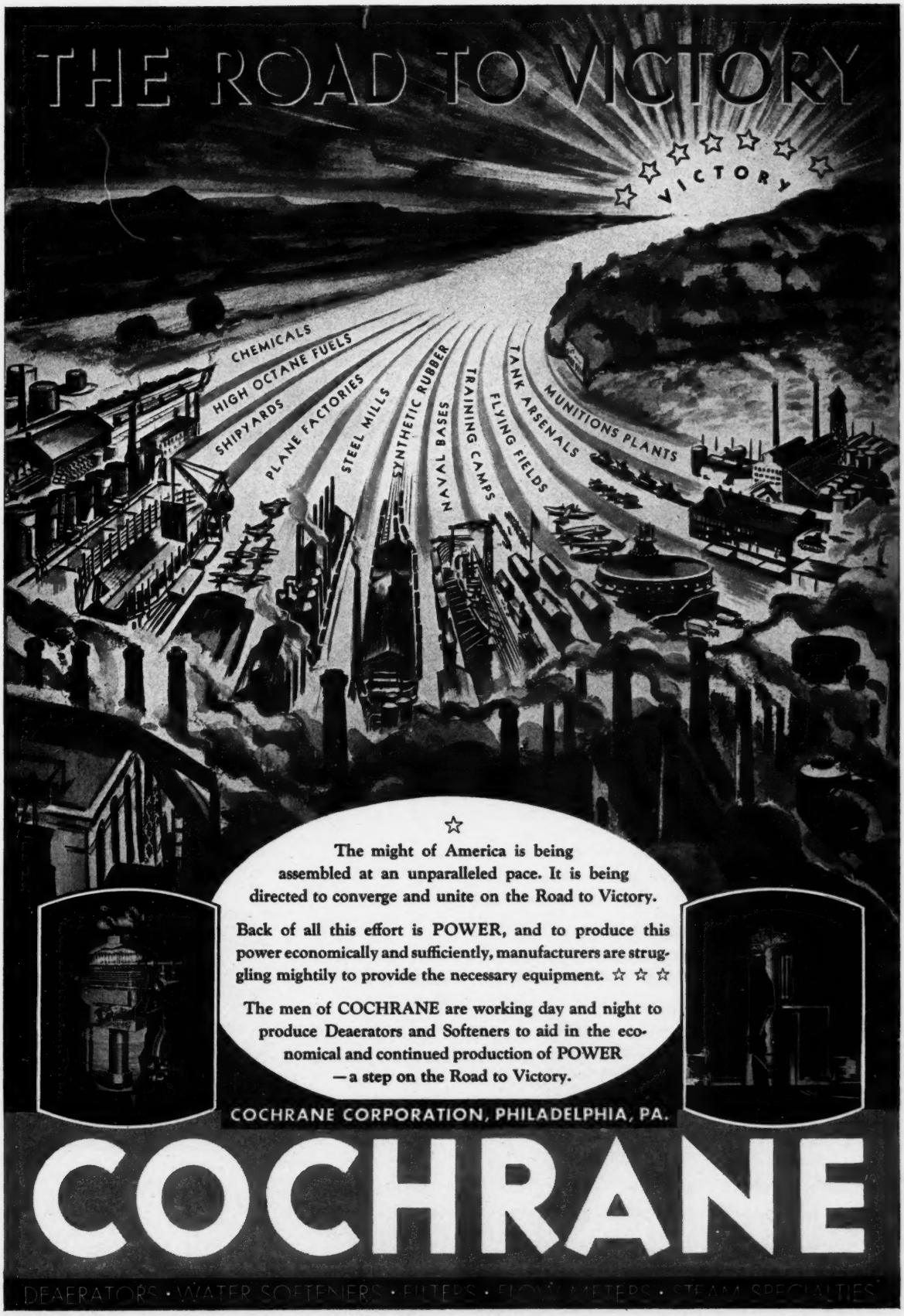
Counter for Protector Tubes

A NEW operation counter for protector tubes used on 13.8 to 138 kv. transmission lines is announced by Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

Six thin copper strips are arranged in a small square counter box mounted on the vent pipe from the protector tube. When the tube operates, part of the gas blast leaves through the small side hori-

zontal tube on which the counter is mounted, blows off a copper blade, and the box falls into another angular position. When a blade is blown out, the new position of the counter indicates the number of times the protector tube has operated.

The device can be mounted on practically all types of protector tubes. Blades are available for reloading, and the counter is provided with a loop-shaped strap which makes it possible to install and remove it by means of a hook stick.



☆

The might of America is being assembled at an unparalleled pace. It is being directed to converge and unite on the Road to Victory.

Back of all this effort is POWER, and to produce this power economically and sufficiently, manufacturers are struggling mightily to provide the necessary equipment. ☆ ☆ ☆

The men of COCHRANE are working day and night to produce Deaerators and Softeners to aid in the economical and continued production of POWER —a step on the Road to Victory.

COCHRANE CORPORATION, PHILADELPHIA, PA.

COCHRANE

DEAERATORS • WATER SOFTENERS • FILTERS • FLOWMETERS • STEAM SPECIALTIES

How We "Sunk" Our Water-logged Float Worries

"THERE was a time when weak-kneed, water-logged floats in our tanks, feed water heaters and liquid level controls gave us plenty of headaches. But we sunk these worries for good when we installed Nicholson Welded Floats."

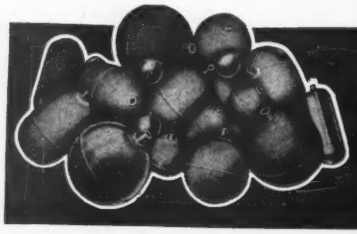
You, too, can end the bother and expense of float replacements by specifying Nicholson Floats. They are dieformed—not spun or laminated—with the welding seam serving as a reinforcing ring. This extra sturdy construction enables Nicholsons to stand hydrostatic pressures up to 2500 lb.

Available in sizes 2 in. to 14 in. diameter, in special, elliptical or cylindrical shapes, in stainless and chromium plated steel. Aso with cadmium, nickel or copper plating. Complete data in Bulletin 339.

Nicholson

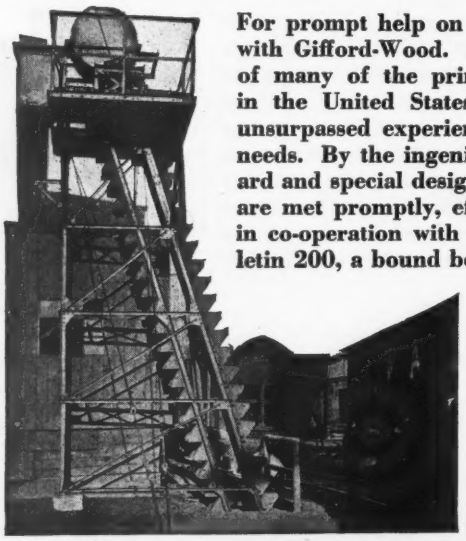
Steam Traps
Flexible Couplings
Steam Separators
Control Valves
Compressed Air Traps
Expanding Mandrels
Arbor Presses

W. H. NICHOLSON & CO.
160 Oregon St., Wilkes-Barre, Pa.



NICHOLSON *Welded* FLOATS

For Prompt Help on Coal Storage



For prompt help on coal storage, get in touch with Gifford-Wood. As designers and builders of many of the principal coal storage plants in the United States, G-W is ready to apply unsurpassed experience in the light of today's needs. By the ingenious combination of standard and special design, individual requirements are met promptly, efficiently and economically in co-operation with your own engineers. Bulletin 200, a bound book of 125 pages is full of proved ideas useful in planning coal storage, coal and ash handling, elevating and conveying systems. A request on your business stationery will bring you a copy.

GIFFORD-WOOD CO.
HUDSON, N. Y.
420 Lexington Ave., New York
565 W. Washington St., Chicago

2540

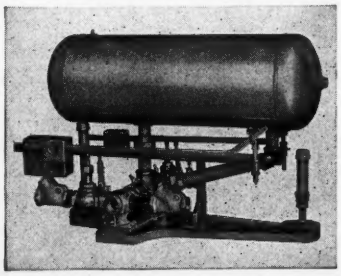
Torque Measuring Wrenches

NEW TORQUE measuring wrenches for use in gaging or measuring tortional force and for measuring the frictional drag in motors or mechanisms is announced by the P. A. Sturtevant Co., Addison, Ill.

They comprise eight models which range in size and capacity from small instrument building wrenches of a few inch-pound capacity to great two handled torque wrenches of 7200 in.-lb. capacity. They are all of the flat tapered beam type with fixed end and top scales and are said to retain their accuracy permanently.

Three-Valve Tilt Trap

A NEW three-valve tilt trap for variable pressures on lifting service has been added to the line of deaerating systems for steam drainage and boiler feeding manufactured by the W. M.

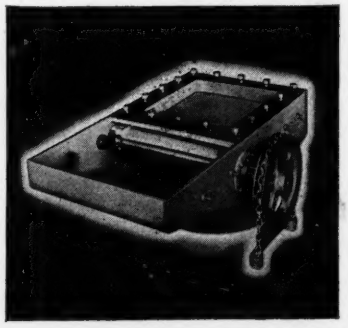


Acker Organization, Inc., Cleveland, Ohio. Construction consists of a female trunnion supported on center bearings and male steam and water ends which are relieved of any weight carried on the packing.

Cast Iron Coal Valves

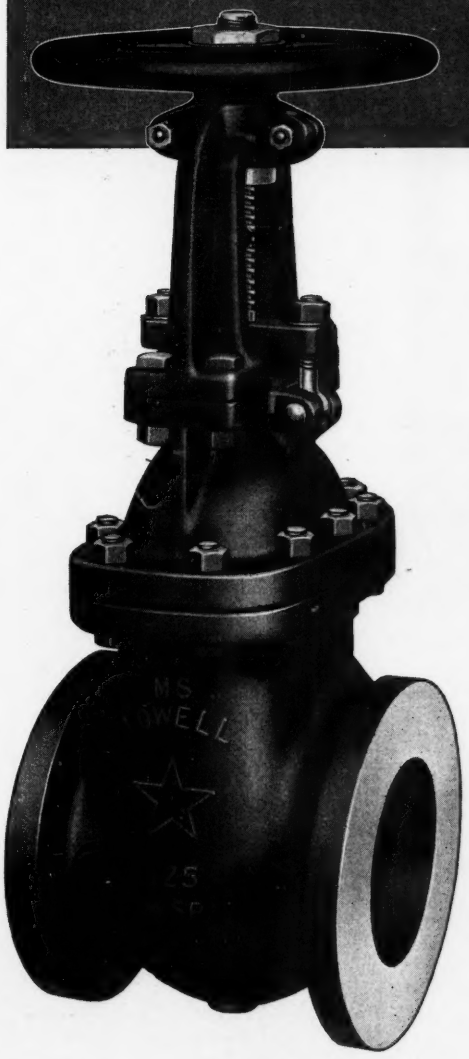
A NEW series of coal valves in sizes ranging from 14 to 20 in. openings is announced by the Beaumont Birch Co., Philadelphia, Pa.

The cast iron corrosion-resistant valves are said to be particularly suited for installation in chutes feeding coal to pulverizers or stokers. A shaft and



pinion assembly with dust tight ball bearing rollers support the gate, which is U-shaped to prevent coal from clogging racks and pinions. Valves can be operated easily even when discharge chute is plugged. They are equipped with a 12-in. rag wheel, chain guard and 10 ft. of chain and can also be furnished with a smooth hand wheel if desired.

A Switch in Time Saves— COPPER and TIN



By switching to POWELL Iron Body Valves wherever they will serve as effectively as bronze, you will help conserve these critical metals.

Before the war made copper and tin virtually "precious metals," many buyers and users of valves automatically thought in terms of bronze. Apparently the impression existed that the desired service could be obtained only by using valves made of this alloy.

But now the necessity for conserving the more critical non-ferrous metals has brought the realization that iron body valves—especially Iron Valves by POWELL—will in many installations serve just as effectively as bronze.

So when you specify POWELL Iron Valves you not only render a patriotic service but, because of the lower priority rating required, you can expect earlier delivery and—YOU'LL HAVE SAVINGS TO INVEST IN WAR BONDS.

The Wm. Powell Co.

Dependable Valves since 1846

Cincinnati, Ohio

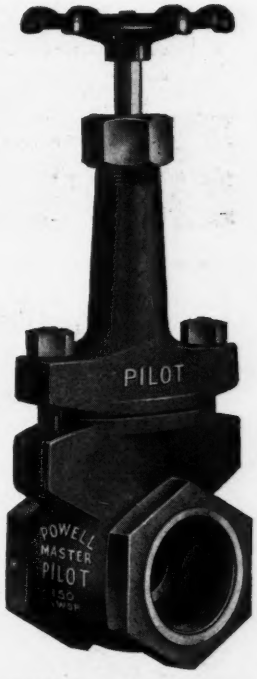


Fig. 1793—Iron Body Bronze Mounted "Model Star" Gate Valve, with flanged ends, outside screw rising stem, bolted flanged yoke, bronze renewable seat rings and taper wedge solid disc. Sizes 2" to 30". Available with taper wedge double disc (Fig. 1444) in sizes 2" to 12". Also made in All Iron—Fig. 1453 with double disc; Fig. 1816 with solid disc.

Fig. 1460—Iron Body Bronze Mounted "Master Pilot" Gate Valve, with screwed ends, rising stem, bolted bonnet and taper wedge solid disc. Made in sizes ¼" to 2" for 150 pounds W.S.P.; 2½" to 4" for 125 pounds W.S.P. Also made in All Iron—Fig. 1462.

POWELL VALVES

DRAVO CORPORATION
300 PENN AVENUE, PITTSBURGH, PA.
REPRESENTATIVES IN PRINCIPAL CITIES

FOR LONGER BEARING LIFE . . .
follow this advice
SHOCK LOADS
DEFENDER
GENERAL USE
HEAVY LOADS
PYRAMID
Use the Proper Metal for Each Bearing
Many bearing failures can be corrected by the use of the proper type of metal. Magnolia's free manual tells what to use where.
REG. U.S. PAT. OFF.

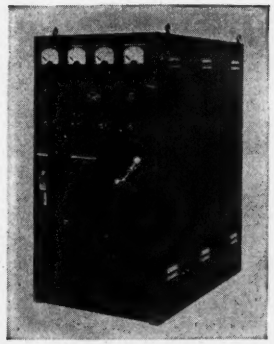
For complete information on Magnolia bearing metals write for our new bulletin which shows what babbitt metal to use where.

MAGNOLIA METAL COMPANY • 18 West Jersey St., Elizabeth, N. J.

MAGNOLIA BEARING METALS

Cable-Fault Reduction Set

A COMPLETE line of metal-enclosed d.c. Cable-fault Reduction and Localization Sets has been announced by the General Electric Co., Schenectady, N. Y. This equipment, for use by utilities in reducing and locating faults on power-cable systems, operates on the "direct" method. While this method necessitates traversing the cable and observing indications at manholes, it is positive, and, for average faults, it is said to require less time than other popular methods of fault location.

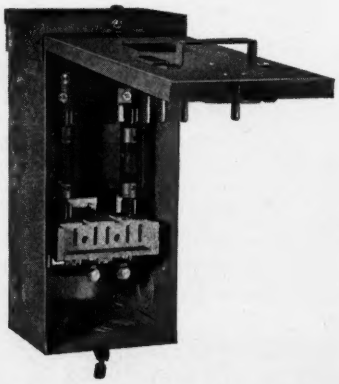


The complete set consists of a Thyratron rectifier, control, motor-driven interrupter, and current-limiting reactor, completely enclosed in a metal housing, and a portable field set for taking readings along the cable. The set first reduces the resistance of the fault to a satisfactory value and then transmits a tracer current which may be easily recognized by traversing the cable with the portable field set.

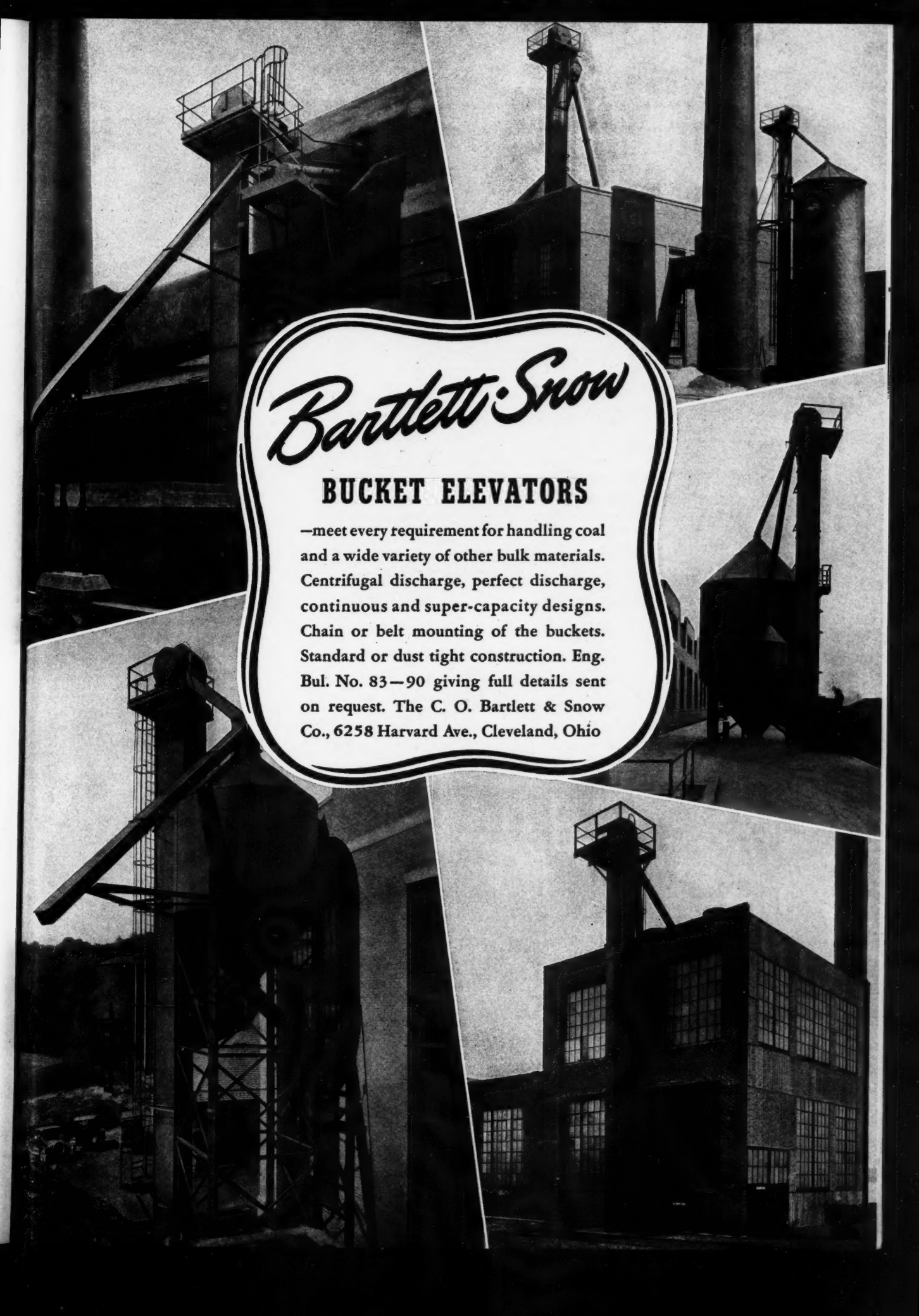
This equipment can be used up to its maximum-rated voltage for direct-current high-potential tests on cable systems and other apparatus. It is available in eight different ratings up to 20,000 v. and up to 20 amp.

Shockproof and Drip-proof Switches

A LINE of shockproof and drip-proof switches designed for naval and marine applications has been announced by the Square D Co., 6060 Rivard St., Detroit, Mich.



These devices offer three outstanding features: Switch blade hinge jaws have been eliminated to conserve copper; a special barrier arrangement prevents fuses from vibrating out of contact due to gun-fire or shock; and the switches


Bartlett·Snow
BUCKET ELEVATORS
—meet every requirement for handling coal and a wide variety of other bulk materials. Centrifugal discharge, perfect discharge, continuous and super-capacity designs. Chain or belt mounting of the buckets. Standard or dust tight construction. Eng. Bul. No. 83—90 giving full details sent on request. The C. O. Bartlett & Snow Co., 6258 Harvard Ave., Cleveland, Ohio

AN IMPORTANT SERVICE IN THE NATIONAL WAR EFFORT

We conserve metals difficult to replace. We have solved the condensate corrosion problem in steam systems.

WE RID YOU OF THIS HAVOC QUARTET
CORROSION
1
Works havoc in your pipes, boilers and heat exchangers
BACTERIAL DEPOSIT
2
Makes itself at home and plugs up your pipes and tubes
HOT WATER SCALE
3
Fights hard to keep you from getting water necessary for production
OILY BOILER DEPOSIT
4
Eats up power and bags your tubes

In the Cook County Nurses' Home in Chicago, where extra heavy wrought iron piping withstood corrosive condensate only thirty days, Haering Glucosates corrected the condition, and test pieces six months later were free from corrosion deposits. We protect metals, in boilers, piping, condensers and heat exchangers, too.

The Glucosates also conserve energy. Less fuel is needed—more production obtained — where Glucosates control scale, corrosion and living organisms. The Glucosates save raw materials too. Less chemicals are used where Glucosates substitute for common inorganic materials.

Write today for free booklets of complete story. We will send sample containers and data forms to enable you to give us an accurate picture of your water problems.

D. W. HAERING & CO., INC.
GENERAL OFFICES 205 West Wacker Drive CHICAGO ILL.
WE READ WATER

ECLIPSE METAL HOSE

Flexes quickly into any position

One of the big advantages of Eclipse Metal Hose is the time and money it saves in assembling lines for handling steam, oil, gas, solvents, chemicals and many other fluids.

This improved seamless, flexible tubing bends to any position, flexes quickly into any location. Also simplifies wartime redesign problems, eliminates the need of long pipe sections and many joints.

Let Eclipse engineers work with you in choosing the proper flexible hose for your plant requirements. Please specify purpose, conditions of installation, pressures and temperature, material to be conveyed.

The Army-Navy "E" for Excellence in Production has been awarded to Bendix Aviation Corporation

Manufactured And Sold By

THE INVISIBLE CREW
Precision Equipment by Bendix
AVIATION CORPORATION

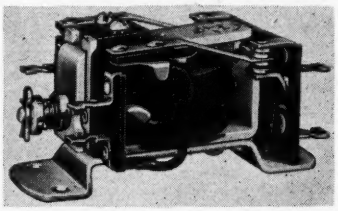
Dept. 19—Phila. Div.
Philadelphia, Pa.

are small in size, providing an important saving in steel and permitting smaller mounting space. The 100 amp. 3 pole, 575-v. a.c., unit is contained in a 7¾ by 17¼ by 6¼ in. cabinet.

A special catch is provided at the top of the cabinets to hold the switches in the off position while replacing fuses or making repairs. When the switch is on it may be secured by a hexagon nut threaded on a swivel bolt. All devices in the line have the standard 250 v. d.c. or 3 pole, 575-v. a.c., services with capacities ranging from 30 to 100 amp.

Metal Base Relays

WARD LEONARD ELECTRIC Co., Mount Vernon, N. Y., announce in its Bulletin 104 relays, small compact remote control units, suitable to applications within their ratings where space is limited, available for operation on a.c. and d.c. circuits.



Standard relays are of the open type, front connected solder type terminals, double pole, double throw, silver-to-contacts rated 4 amp. up to 24 v. a.c. or d.c., and 4 amp. a.c.; 1 amp. d.c. from 25 to 115 v. These relays are vibration resistant up to ten times gravity in the energized position. Overall height from base to armature is 1¼ in.

MANUFACTURERS' PERSONALS

Sauerman Bros., Inc., Chicago, Ill., announces the appointment of J. R. Norton, 11 W. 42nd St., New York, N. Y., as its distributor in that territory. Mr. Norton succeeds W. R. Elden who died recently.

George E. Clifford has been elected a vice-president of The National Supply Co., Pittsburgh, Pa. In this capacity he will supervise the sales of certain munitions. He will also continue as vice-president in charge of sales for Spang Chalfant, Inc.

C. F. Poirier, vice-president of Crocker-Wheeler Electric Mfg. Co., Ampere, N. J., has been appointed Electrical Consultant to the Shipbuilding Division of WPB. Mr. Poirier's principal duties will consist of analyzing productive capacity in the electrical industry. He has been a member of the WPB advisory committee for the Electric Motor and Generator Industry for the past several months.

Russel L. Whitney has been appointed sales manager of the Transformer Division of the Westinghouse Electric & Mfg. Co. at Sharon, Pa., A. C. Farmer has been named assistant to the vice-president, and A. P. Bender has been named assistant sales man-

Vogt

for better DROP FORGED STEEL Fittings

in SOCKET WELD and SCREW END TYPES

SOCKET WELD TYPE

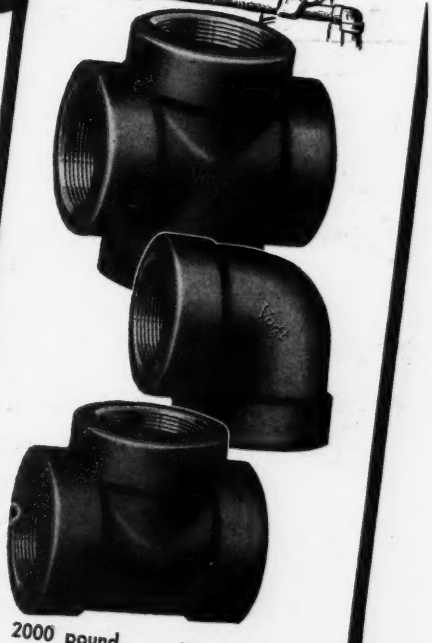
Schedule 40—(Standard)
Schedule 80—(Extra Heavy)
Schedule 160 & Double Extra Heavy
Sizes 1/4" to 6"

Choose either type with Confidence, when Drop Forged by **VOGT!**

Vogt drop forged material is uniform in structure, fine grained and free from porosity, with a "plus" of strength and toughness that safely withstands the strains and shocks of service at high temperatures and high pressures. Ells, Tees, Crosses, etc., are available in various alloys to meet any of your special service conditions.

WRITE FOR BULLETINS OR ANY SPECIAL INFORMATION

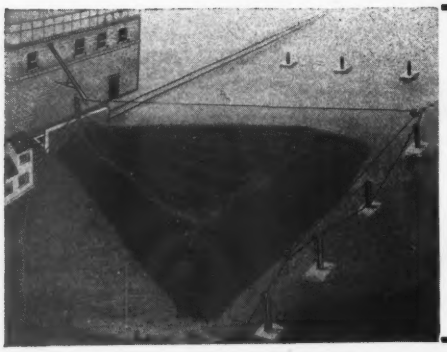
SCREW END TYPE



2000 pound 3000 pound
6000 pound
Sizes 1/8" to 6"

HENRY VOGT MACHINE CO., Incorporated, LOUISVILLE, KY.

BRANCH OFFICES: NEW YORK · PHILADELPHIA · CLEVELAND · CINCINNATI · ST. LOUIS · CHICAGO · DALLAS



STORE MORE at LOWER COST

PREVENT *Spontaneous Firing*

Stop Waste
Save Space

Write for Literature

● With a Sauerman Power Drag Scraper you can store more coal in a given space, with less handling, less wastage and without "chimnies" or air pockets to cause spontaneous firing. Operated by one man, the Sauerman Scraper "stacks" coal in homogeneous layers in even sided, flat topped piles of any predetermined height and shape.

For over 30 years Sauerman coal handling equipment has been specified to store more in any shape or size of space at lower cost, and to eliminate ground wastage and fire loss.

SAUERMAN

POWER SCRAPERS **FOR STOCKPILING**

Sauerman Bros., Inc., 586 So. Clinton St., Chicago, Ill.

Save Time—Look First In
The "Where-To-Buy" Directory

Suppose you need gaskets, gauge glasses, pump governors, steam traps or other power service equipment in a hurry.

Do as hundreds of engineers and plant executives do—turn first to the handy "Where-To-Buy" Directory published in this issue.

You'll find there comprehensive up-to-date product listings of well-known concerns which advertise regularly in POWER PLANT ENGINEERING. They probably have branches or sales agents in your locality.

ager, as announced by H. V. Putman, vice-president and manager of the Transformer Division.

Carl A. Salmonsen has been appointed assistant manager of the Lynn, Mass., River Works of the General Electric Co., as announced by G. M. Stevens, Acting Manager of the Works. Mr. Salmonsen has been with G.E. since 1909, starting as an office boy in the Schenectady works and working his way up through various departments in the company to his present position.

E. L. Midgette, Professor of Machine Design at the Polytechnic Institute of Brooklyn, has been retained as consultant for the American Engineering Co. in the development of new designs or products and the improvement of existing ones.

H. T. Warren has been appointed sales manager of the newly consolidated Eastern New England and Central New England territories of The McClave Co., as announced recently by R. B. McClave, president. Mr. Warren's headquarters will be at 125 Trumbull St., Room 503, Hartford, Conn., and his territory will comprise all of New England with the exception of Fairfield County, Conn., Berkshire and Bristol Counties, Mass., and the State of Rhode Island.

William F. Lahl, research engineer in the Engineering and Research Div. of Crane Co., Chicago, has accepted an appointment as consultant in the valve and fitting section of the Shipbuilding Section of the War Production Board. Mr. Lahl is well qualified for his new duties, having had 20 yr. experience in the design, manufacture, application and sale of valves and fittings.

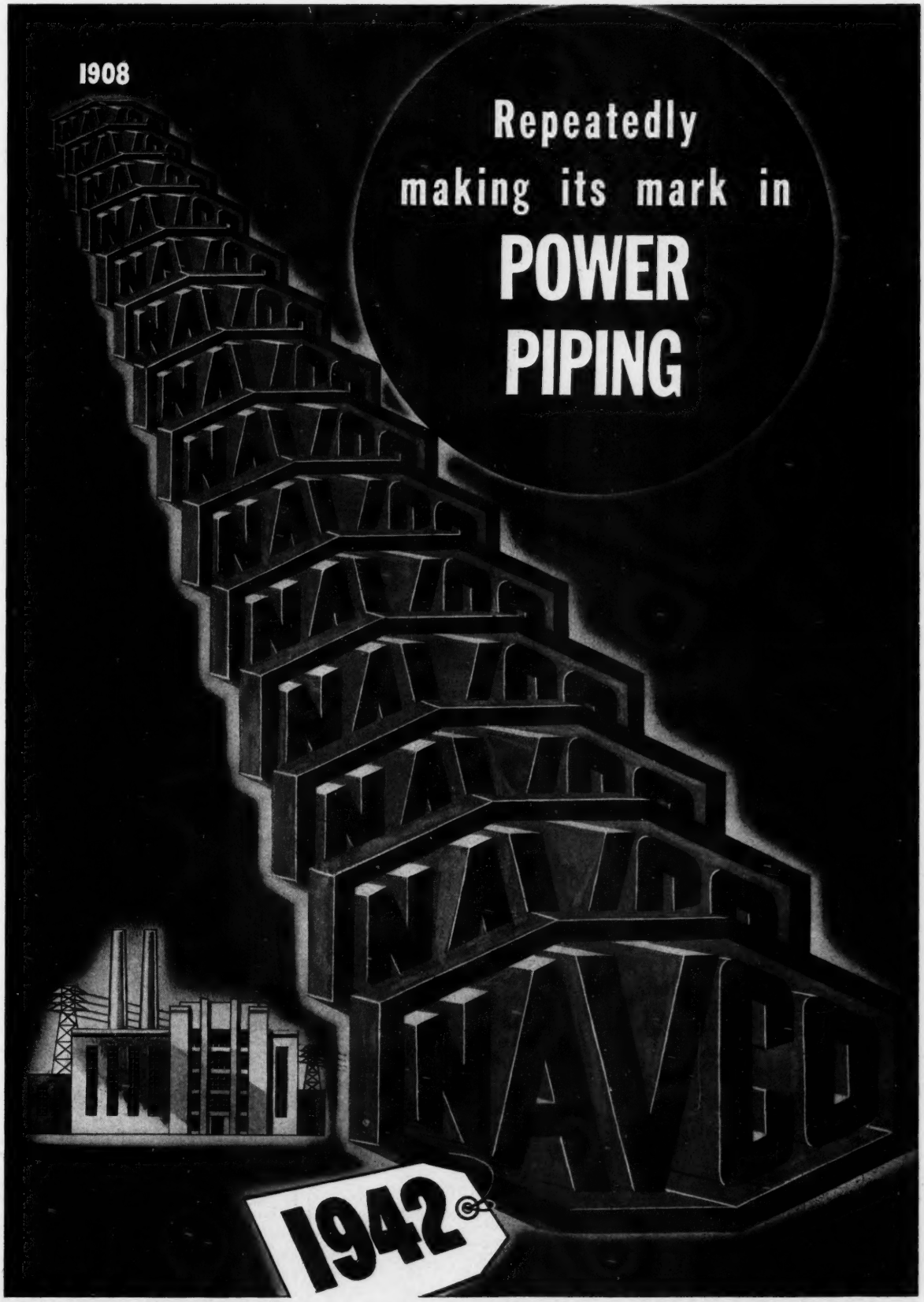
William Simpson, a graduate engineer of Pennsylvania State College, and for several years design engineer for Baldwin Locomotive Works, Baldwin-Southwark Corp. and Brill Car Co., has joined the engineering staff of Milton Roy Pumps, Philadelphia, Pa.

Allis-Chalmers Changes

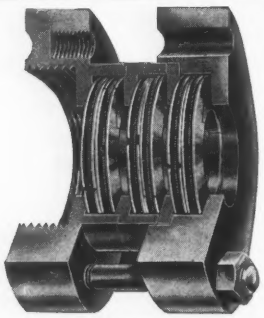
SEVERAL changes in personnel have been announced by Allis-Chalmers Mfg. Co. M. L. Carson, acting engineer-in-charge, has been appointed manager of the engine and condenser department; W. L. Manly has been named manager of the feedwater treating department; and Edwin H. Brown, engineering vice-president has been granted an indefinite leave of absence to become assistant chief of the iron and steel branch in charge of the plant facilities section of the War Production Board.

Mr. Carson has been with Allis-Chalmers since 1916, serving in various capacities. In his new position he will direct sales and engineering of engine and condenser equipment as well as special work in connection with the war effort, including forging, casting, welding and machining of products not manufactured by the company in peacetime.

Mr. Manly will direct service operations of the feedwater treating department for the entire country. He has



NATIONAL VALVE MANUFACTURING COMPANY • PITTSBURGH, PENNA.



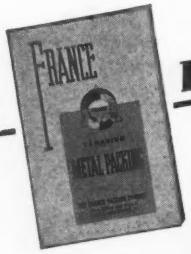
What Is the Life of FRANCE METAL PACKING

City of Erie, Pa., Waterworks: "The France Packing in a Holly pumping engine has been in service **32 years** and is still working satisfactorily."

Illinois Power & Light Corp., Champaign, Ill.: "France Metal Packing used on our engines for **27 years** and is still working under a pressure of 170 lbs. superheated. ....will in all probability outlive us."

Worcester Gas Light Co., Worcester, Mass.: "France Packing has always been tight. ....Same compressor packed with ordinary packing required a large amount of labor to keep the stuffing boxes tight."

You can't expect more—why accept less?



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44-page Catalog of useful and valuable information. Write for your free copy of Catalog M-5, with facts on

- **Packing Designs for any Service**
- **Installation Procedure**
- **Methods of Lubrication**
- **Pressures and Temperatures**
- **Oil Return and Stripping Rings**
- **Handy Reference Tables**

Request France Engineers to analyze your packing requirements. There is a representative close at hand.

THE FRANCE PACKING COMPANY
Tacony, Philadelphia, Penna.
Branch Offices in Principal Cities

Original **FRANCE METAL PACKING**

had many years of experience in the feedwater field and has conducted practical research on industrial feedwater problems based on his experience.

Mr. Brown's work with the WPB will be in connection with the task of guiding the construction and utilization of steel plant facilities. During his absence the engineering and development department of the company will be under the direction of Forrest Nagler, chief mechanical engineer.

Wesselhoff, Morse Chain Co., Manager

EARL WESSELHOFF, well known in the industrial power transmission field, has been appointed manager of the Boston Branch of Morse Chain Co., as announced by Walter Bertram, Sales Manager. Mr. Wesselhoff succeeds C. L. Pratt, Jr., who recently resigned. In his new position, Mr. Wesselhoff will serve the New England States in a sales, engineering and service capacity.

Mr. Wesselhoff joined Morse Chain Co. 22 yr. ago as automatic timing chain drive engineer. During that time he has served in several engineering capacities and at one time was chief engineer of the Morse Indexing and Free-Wheeling Clutch Lines. He had much to do with the early development and application of silent automatic timing chain drives.

Dr. W. M. White Retires

DR. WILLIAM MONROE WHITE, internationally known engineer, has retired as manager of the hydraulic turbine department of the Allis-Chalmers Mfg. Co., as announced by Walter Geist, president of the company. Mr. Geist also announces the appointment of J. Frank Roberts to succeed Dr. White and the selection of H. P. Binder as manager of the centrifugal pump department.

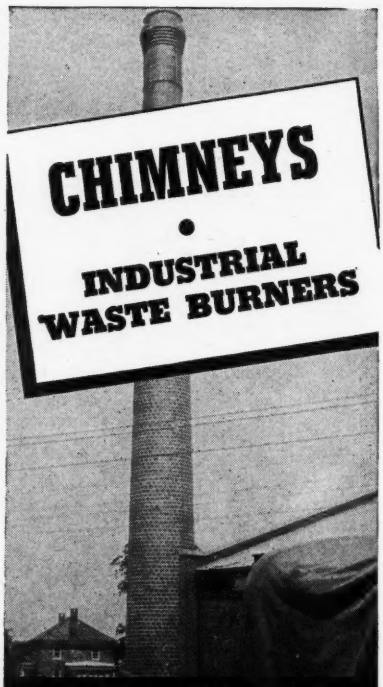
Dr. White entered the employ of Allis-Chalmers in 1911 and during his years with the company engineered some of the largest hydroelectric installations in the world, including Niagara Falls, Boulder Dam and TVA. He is credited with about 50 patents on his many inventions and his work as an engineer and as an author is widely recognized.

Mr. Roberts became associated with the company in 1919, entering the graduate engineer training course at that time. He became office manager of the hydraulic department, a position which he held until 1927 when he left the company to engage in utility work in Canada and later joined the TVA.

Mr. Binder has been with the company 30 yr. and has been assistant manager of the hydraulic department in charge of centrifugal pump sales and engineering since 1940.

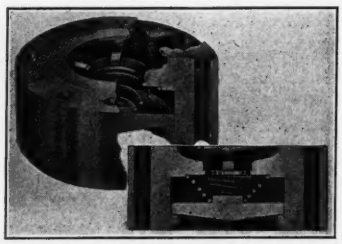
General Electric Personnel Changes

K. R. VAN TASSEL has been appointed Manager Sales of the newly formed Integral-horsepower Motor Section of the General Electric Co.'s Motor Division and J. L. Townsend has been appointed Assistant Manager Sales, Fractional-horsepower Motor Section as announced recently by



AMERICAN CHIMNEY CORP.
147 Fourth Ave., New York City
BRANCHES: BOSTON • PHILADELPHIA
BUFFALO • CLEVELAND • DETROIT

WILLIAMS-HAGER
Flanged Silent Check Valve



- **Non-Wear Conical Spring**
- **Renewable Disc and Seat**
- **Works In Any Position**
- **Noiseless In Operation**
- **Protection Against Water Hammer**

These improved side-guided check valves stay tight under every condition of service and pressure. Easily installed between flanges and readily removed for inspection. Sizes up to 20 in. and for pressures to 6,000 lb. They will handle all liquids, hot or cold—water, oil, gasoline, chemicals, etc. Get further details about this economical protection for pumps and service lines.

Ask for Catalog No. 142

THE WILLIAMS GAUGE CO.
3000 Pennsylvania Ave., Pittsburgh, Pa.

FOSTER ENGINEERING COMPANY
FOSTER AUTOMATIC VALVES
ESTABLISHED 1879

for Accurate REGULATION OR CONTROL

PRESSURE REDUCING REGULATORS

for STEAM, LIQUIDS, GASES

One of the latest developments in pressure reducing regulators — an air-loaded dome design for the accurate regulation of high and low pressure fluids.

Built for initial pressures up to 2500 lbs. per sq. in. and temperatures up to 1000° F., this valve will handle pressure reductions of a magnitude previously impractical in a single stage.

There are no operating springs in this simple, single-seated regulator. A constant loading is imposed by air, thereby insuring constant regulation. Accuracy is unaffected by spring deflection and hysteresis.

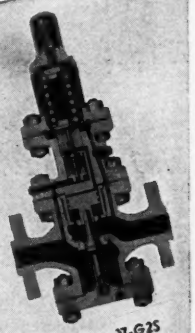
Type 39-Q1. Double seated
Type 39-Q2 also available

for STEAM

Built for pressures up to 1500 lbs. and 900° F. total temperature, the improved Foster Type 37-G2 Pressure Reducing Regulator assures accurate regulation despite widest variations of initial pressure.

Single-seated for dead-end service, both pilot and main valve are protected by internal strainers from pipe line sediment.

Streamlining of body distributes and assures free flow of steam, while construction of main valve provides maximum lift to minimize pulsating and wire drawing—affords graduated flow and modulating control. Can be fitted with locking cap or hand wheel.



Type 37-G2S

TEMPERATURE REGULATORS

The Foster Type 38-T9 Temperature Regulator is an internally pilot-operated, piston-actuated valve for controlling temperatures within ± 1° F.

Single-seated for dead-end service, this regulator is built in sizes of ½ to 12 inches for pressures of 25 to 450 lbs., and for temperatures up to 300° F.

An essential feature of this design is that with relatively little temperature change (± 1° F.), the valve will travel from closed to fully opened position.

This regulator also is equipped with a temperature over-travel protective device.

Type 38-T9

STEAM SIREN

This siren can be heard for miles, and works fast—its rising sound pitch or howl reaches its peak in from three to five seconds, depending on the maximum pitch for which this siren is set. It can be used for signaling because of its sharp sound cut-off.

If a constant pitch is desired, this siren can be so ordered or factory converted into a revolving cylinder-type of horn which produces practically a single pitch from starting to full speed as contrasted with conventional rising pitch or howl.

Type 45
A smaller size—
Type 30—available

- REDUCING VALVES
- TEMPERATURE REGULATORS
- PUMP GOVERNORS
- SIRENS
- ...plus eight sections of useful engineering data

The above shows but four of the scores of Foster Automatic Valves described in our new complete catalog. Write for your copy, on your company's letterhead, please.

FOSTER ENGINEERING Company

109 MONROE STREET, NEWARK, N. J.

At Booth 428 Madison Square Garden—November 30 to December 4, 1942.

12-FE-4

NEED A NEW DOOR LINING *or* SPECIAL REFRACTORY SHAPES... *FAST?*

Cast them yourself... FAST. Use a Castable Refractory made with **LUMNITE!**

IF YOU'RE in a hurry to replace a door lining, arch, baffle, burner block, or some special refractory shape, you can do it quickly with a Castable Refractory.

Pour the dry castable mixture out of the bag and mix it with water right on the job. The resulting Castable Refractory, poured in a form to make jointless one-piece walls or arches, or placed in a home-made mold to get a precast shape, is ready for service 24 hours after mixing. No waiting... no delay... no production time out.

A Castable Refractory handles as easily as ordinary concrete. There's no cutting or fitting... no ramming... practically no shrinkage in drying or firing. It's not affected by steam or moisture. Has high resistance to spalling. Can be stored indefinitely.

Specify Castable Refractories made with LUMNITE, and you get a balanced, always uniform product, made with carefully selected aggregates and the hydraulic binder which made Castable Refractories possible. Castables to meet different temperature and insulation needs are made by refractory manufacturers and sold by their distributors.

The Atlas Lumnite Cement Company
(United States Steel Corporation Subsidiary)
Chrysler Bldg., New York City

W. H. Henry, Manager of the Motor Division, Industrial Department. Mr. Henry also announced that D. A. Yates of the same Division has been placed in charge of the Lynn Motor Group at the company's Lynn, Mass., plant.

Youngstown Miller Changes

YOUNGSTOWN MILLER CO., INC., Sandusky, Ohio, announces the following changes in its sales organization: Reaves E. Strobel formerly manager of the New York Office, has been transferred to the factory at Sandusky in charge of sales; R. Elliott Sullivan has been appointed in charge of the Pacific Coast Territory with headquarters at Carlsbad, Calif.; and S. C. Cutler, formerly Florida representative, has been transferred to Washington, D. C.

MANUFACTURERS' NEWS

The Hedges-Walsh-Weidner Division of Combustion Engineering Co., Inc., was presented the Army-Navy "E" on October 27 at its plant in Chattanooga, Tenn.

The Bendix Aviation Corp., Philadelphia Division, was awarded the Army-Navy Production "E" on November 12.

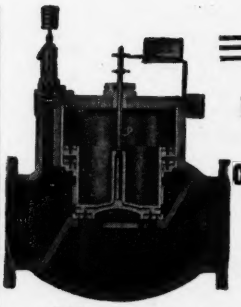
The Bird-Archer Co. announced recently that its Chicago office moved from 2030 N. Natchez Ave. to the Wrigley Building.

Hahn Engineering Co., 233 Broadway, New York City, recently moved their offices to 30 Church St.

The B. F. Sturtevant Co. recently announced the opening of a new branch plant at LaSalle, Ill., to serve as the company's Midwest production center, superseding the factory at Sturtevant, Wis., which was recently closed. The new plant will be operated by J. F. Gibson as superintendent under the supervision of F. Herlan, general manager of the company's Midwestern division.

New Blackout Plant

THE Allis-Chalmers Manufacturing Co. recently dedicated its new blackout supercharger plant. Speakers on the program included Walter Geist, Allis-Chalmers president; Brig. Gen. K. B. Wolfe, chief of the production division of the air forces materiel section, Wright Field, Dayton, Ohio; Fred Mackey, manager of the supercharger works; Julius Heil, governor of Wisconsin; the Rev. Raphael McCarthy S.J., president of Marquette University; James M. White, Allis-Chalmers general works manager; Maj. Millard M. Frohock, resident representative at the new plant for the air forces, and Maj. Carlos Cochrane. The new plant was started last October, the first machine was placed in operation in May, and the superchargers are now being shipped ahead of schedule.



ELECTRIC DOUBLE CUSHIONED CHECK VALVE

★

This valve is for use in connection with remote tank storage service with valve located adjacent to motor centrifugal pump, also where a high-low pressure or float-operated switch located at tank is wired to the valve in order to accomplish complete automatic sequence of operation for starting and stopping the pump with respect to storage water levels.

Sizes 3" to 36", angle and globe patterns.

Write for Specifications

GOLDEN-ANDERSON VALVE SPECIALTY CO.
Fulton Building Pittsburgh, Pa.

Opportunities Offered

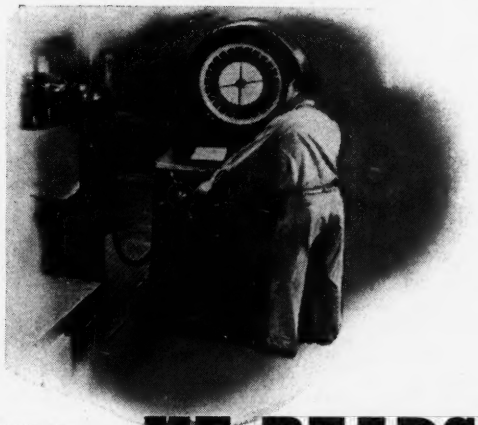
Profitable small equipment side line now available for bituminous coal and stoker salesmen. Commission. Give details of territory covered. Address Box 1411, POWER PLANT ENGINEERING, 53 W. Jackson Blvd., Chicago, Ill.

CLASSIFIED

For Your Convenience

Everything from Air Compressors to Whistles—266 different classes of products used in operating and maintaining power plants—are listed each month in the Where-To-Buy section of this magazine.

Make it a rule to turn first to this up-to-date directory when you're in the market for power service equipment and supplies. It's classified for your convenience, can save you time and money.



HE READS THE *"Life-lines"* OF GLOBE PRESSURE TUBES

The life expectancy of a Globe Pressure Tube is an open book to the Globe metallurgist. Frequent laboratory tests, including photomicrographic inspection, in addition to careful and thorough individual gauging for wall thickness and outside diameter, insure a consistently uniform quality of product.

Such extra precautions in manufacture may readily be translated into longer life and greater safety in use. This extra margin of safety and strength means lower cost in the long run for the user of Globe Pressure Tubes.

Globe Engineers are always available to assist in selecting a tube with the exact characteristic you require.

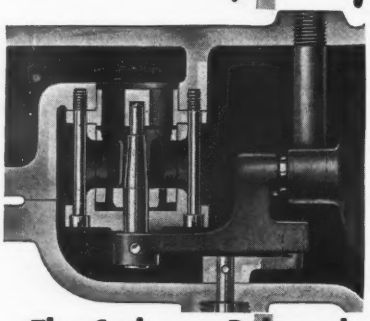
GLOBE STEEL TUBES CO., Milwaukee, Wis.

STAINLESS TUBES
BOILER TUBES
CONDENSER AND HEAT EXCHANGER TUBES
MECHANICAL TUBING

GLOBE STEEL *Tubes*

GLOBE TUBES

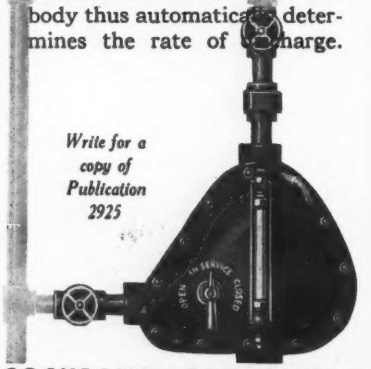
The Secret of this Drainer's Great Capacity



The Cochrane Balanced Rotary Multiport Valve

COCHRANE DRAINERS are famous among power plant operators for their tremendous discharge capacity. Wherever large quantities of condensate must be continuously removed as from evaporators, heaters, separators, coils or steam lines, under vacuum or positive pressures, Cochrane Drainers are specified by experienced plant men. The secret lies in their multiport valve construction, a series of longitudinal parts in the rotary valve matching similar parts in the stationary valve sleeve. The height of the condensate in the drainer body thus automatically determines the rate of discharge.

Write for a copy of Publication 2925



COCHRANE CORPORATION
3123 N. 17th St. Philadelphia, Pa.

COCHRANE STEAM SPECIALTIES

NEWS FROM THE FIELD

The Technical Valuation Society will hold its annual forum on December 12 in New York City. Papers on many pressing valuation problems, particularly in relation to the war effort, will be presented by well known economists, appraisers and valuation engineers. For further information write W. C. Fisher, Chairman of the Program Committee, or C. I. McErlain, Chairman of the Dinner Committee, at the Society's headquarters, 33 West 39th St., New York, N. Y.

Metallizing Engineering Co., Inc., is offering a total of $650 in War Bonds for details of maintenance and salvage procedures with the metal spraying process. First prize is $250, second prize $150, third prize $100, and three prizes of $50 each. Contest closes December 15th. Complete information and entry forms are obtainable from Metco News, 21-07 Forty-first Ave., Long Island City, N. Y.

The Westinghouse Order of Merit has been conferred upon two veteran engineers, Charles F. Wagner and Dean Harvey, for outstanding contributions to the electrical industry. Mr. Wagner, manager of central station engineering at East Pittsburgh, was honored for his lightning studies which have won him international recognition, and Mr. Harvey, materials and standards engineer at East Pittsburgh, for his contribution to the war effort as a member of the Conservation Division of the War Production Board.

G.E. Suggestion System Announces Winners

GENERAL ELECTRIC workers have broken all company records this year for worthwhile suggestions for saving material and time in war production, according to an announcement by William E. Owen of the company suggestion system. During the first 10 mo. of the year company employes were paid $115,000 for 12,250 ideas. The previous high was $104,000 which was set in 1929. Most of this $115,000 award money has been put into War Bonds by the recipients.

The principal prize winning suggestions and their authors are as follows:

Spencer Frederick received a total award of $1025 for suggesting two methods of nesting various segments more closely together so that a greater number can be cut from steel plates, with a consequent reduction in scrap. It is estimated that these methods will save 647,000 lb. of steel, enough to make 80,000 Garand rifles.

L. E. McElhiney received $750 for a suggestion which permits greater utilization of steel in the manufacture of motors now performing a variety of functions in war plants.

Robert J. Stuart received $750 for adapting a fan already available to take the place of a fan used in welding which could not be obtained because of shortages of material.

Howard Wildman received $500 for devising a standard fixture for the machining of parts for naval ordnance.

(Continued on page 158)

HENSZEY
BOILER FEED REGULATORS

GOES IN FEED LINE

The Henszey Boiler Feed Regulator controls boiler water levels continuously and accurately under *all* load conditions!

These simple, compact, self-contained units go right in the feed line and require no additional structural support. They are as easy to install as a simple gate or globe valve. Once installed and set for operation no further attention is necessary—nothing to get out of order—nothing to reset.

Send for latest Bulletin containing full details.

HENSZEY COMPANY
Dept. C12—Watertown, Wis.

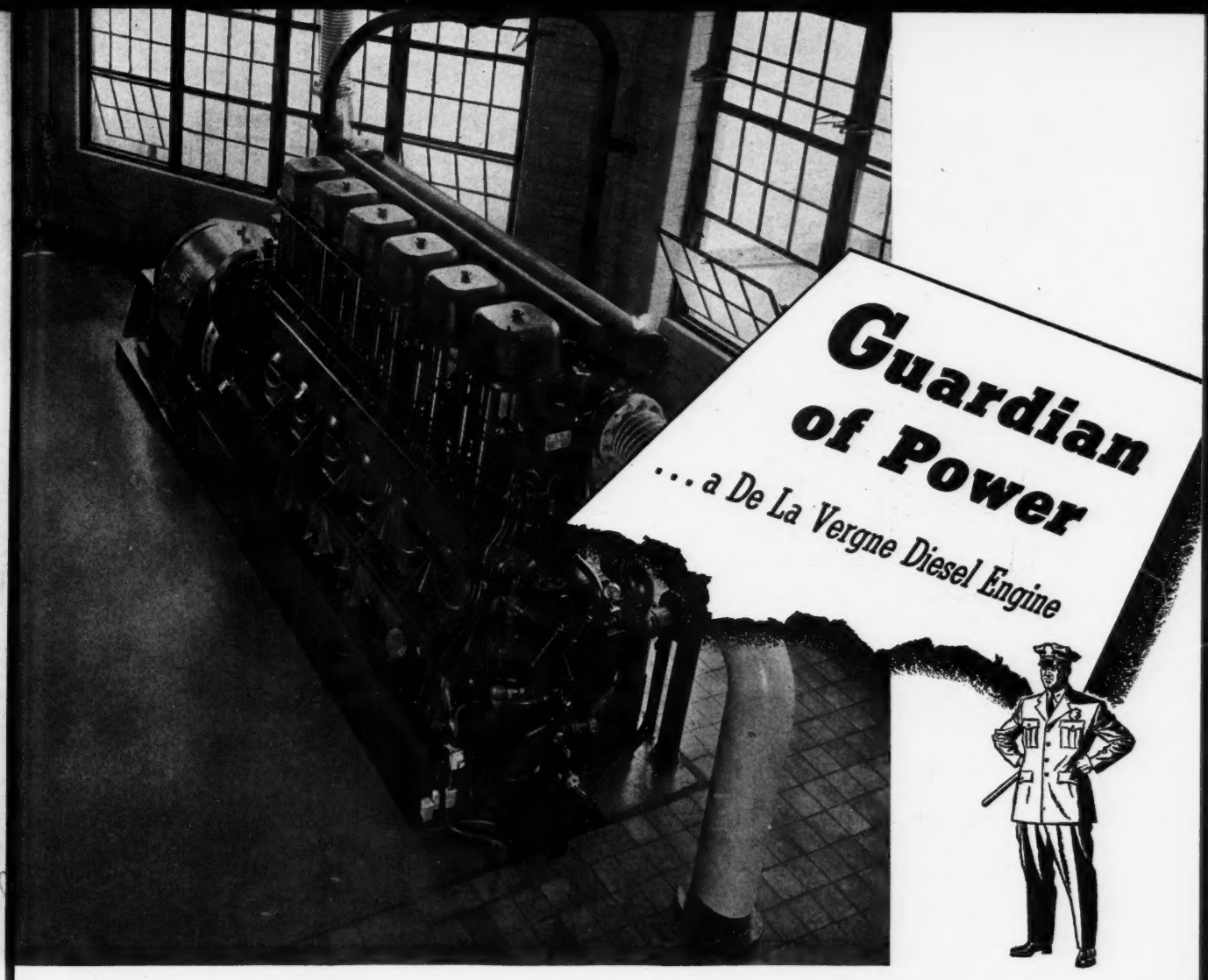
Unseen But Effective

The DE LAVAL IMO PUMP

within the oil reservoir here shown is driven by the 7200 rpm. motor to supply pressure oil for hydraulic controls. The simplicity, compactness and lightness of the IMO pump, as well as its high efficiency, recommend it for many uses where rotary pumps are desirable but have heretofore proved too cumbersome. The IMO is also used as an hydraulic motor.

Ask for Publication I-97

IMO PUMP DIVISION
of the De Laval Steam Turbine Company
Trenton, New Jersey



De La Vergne built the first commercially successful oil engine in America in 1893 and since that time has manufactured dependable diesel engines for hundreds of applications. In providing low cost power for stationary service installations, De La Vergne Diesel Engines have an exceptional record of economical operation and maintenance.

Today's production requirements demand unfailing, uninterrupted power supply. Installations of De La Vergne Diesels are meeting this demand in central stations, industrial and commercial plants, mills, mines, and cold storage plants throughout the nation.

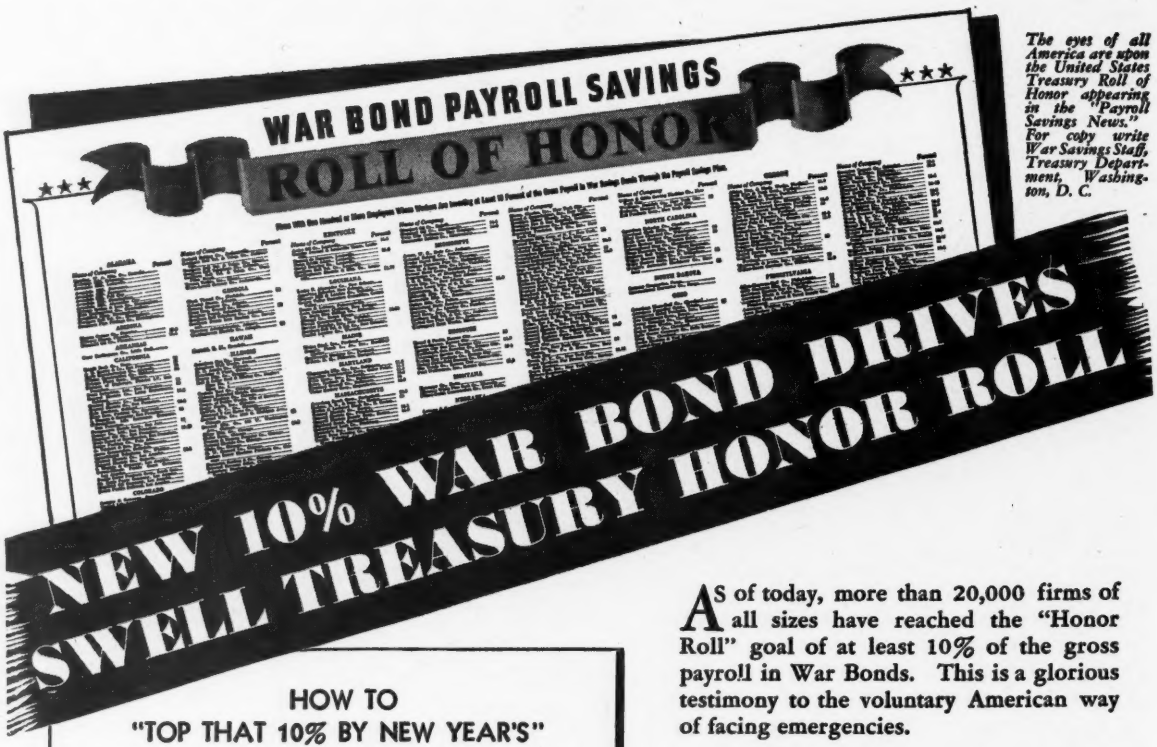
Engineered and designed to fulfill specific power needs, De La Vergne Diesels range in size from 200 bhp to 1,500 bhp. Low maintenance costs, long life, and unusual quietness of operation are features of all De La Vergne 4-cycle diesel engines.

Whatever your power problem is, it will pay you to consult a De La Vergne engineer. The combined knowledge and experience gained in 49 years of diesel engine manufacturing is utilized in the solution of every new problem.

BALDWIN
De La Vergne
SALES CORP.

BLW
THE BALDWIN GROUP

SUBSIDIARY OF THE BALDWIN LOCOMOTIVE WORKS • PHILADELPHIA



The eyes of all America are upon the United States Treasury Roll of Honor appearing in the "Payroll Savings News." For copy write War Savings Staff, Treasury Department, Washington, D. C.

HOW TO "TOP THAT 10% BY NEW YEAR'S"

Out of the 13 labor-management conferences sponsored by the National Committee for Payroll Savings and conducted by the Treasury Department throughout the Nation has come this formula for reaching the 10% of gross payroll War Bond objective:

1. ***Decide to get 10%.***
   It has been the Treasury experience wherever management and labor have gotten together and decided the job could be done, the job was done.
2. ***Get a committee of labor and management to work out details for solicitation.***
   a. They, in turn, will appoint captain-leaders or chairmen who will be responsible for actual solicitation of no more than 10 workers.
   b. A card should be prepared for each and every worker with his name on it.
   c. An estimate should be made of the possible amount each worker can set aside so that an "over-all" of 10% is achieved. Some may not be able to set aside 10%, others can save more.
3. ***Set aside a date to start the drive.***
4. ***There should be little or no time between the announcement of the drive and the drive itself.***
   The drive should last not over 1 week.
5. The opening of the drive may be through a talk, a rally, or just a plain announcement in each department.
6. Schedule competition between departments; show progress charts daily.
7. Set as a goal the Treasury flag with a "T."

AS of today, more than 20,000 firms of all sizes have reached the "Honor Roll" goal of at least 10% of the gross payroll in War Bonds. This is a glorious testimony to the voluntary American way of facing emergencies.

But there is still more to be done. By January 1st, 1943, the Treasury hopes to raise participation from the present total of around 20,000,000 employees investing an average of 8% of earnings to over 30,000,000 investing an average of at least 10% of earnings in War Bonds.

You are urged to set your own sights accordingly and to do all in your power to start the new year on the Roll of Honor, to give War Bonds for bonuses, and to purchase up to the limit, both personally and as a company, of Series F and G Bonds. (Remember that the new limitation of purchases of F and G Bonds in any one calendar year has been increased from $50,000 to $100,000.)

TIME IS SHORT. Our country is counting on you to—

"TOP THAT 10% BY NEW YEAR'S"

EVERYBODY EVERY PAYDAY AT LEAST 10%

Save with
War Savings Bonds

This space is a Contribution to America's All-Out War Effort by POWER PLANT ENGINEERING

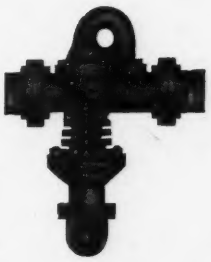
FOR OVER 50 YEARS

Sincerely yours ✻

HAS BEEN PROUDLY INSCRIBED, IN EFFECT IF NOT IN FACT, ON THOUSANDS OF BUILDERS FLOW METERS AND CONTROLLERS!

If You Need
MORE STEAM NOW

Install Shunt Meters to control steam use and detect avoidable losses.



With accurate records of steam flow, savings of from 15% to 30% are common.

Write for Bulletin 307

✻ Back in the old days, second-rate Roman sculptors who made unsightly nicks in the marble would secretly patch up the flaws with a mixture of wax and marble dust. These patches would drop out later on and honest artists suffered so much that they began labelling their handiwork "Sine Cera" (i. e. "Without Wax"); from this we derive our word "sincere" meaning honest, genuine, real.

ARMY E NAVY
AWARDED AUG. 1 st 1942

BUILDERS-PROVIDENCE, INC.

Est. 1820 • DIVISION OF BUILDERS IRON FOUNDRY • Inc. 1853

37 CODDING STREET • PROVIDENCE, R. I.

BUILDERS
RECORDING-INDICATING-CONTROLLING
Instruments

It is estimated that this suggestion will save 5000 man-hours this year.

Robert Spring received $500 for devising an improvement in the machining of a tuning arrangement for aircraft radio units which speeds production.

John Vos received $400 for suggesting an improvement in assembling radio equipment for the Army and Navy which will save thousands of man-hours and conserve large quantities of scarce materials.

Miss Laura Garrison received $350 for making an improvement in a type of radio transmitter part which goes into aviation equipment.

Axel Johnson received $250 for suggesting a pattern change which enables a greater number of brake wheels to be obtained from the same amount of molten metal. These wheels are part of the electrical equipment for cargo ships. This change will save 22 t. of steel, or enough to make 44,000 bayonets, as well as 10 per cent of the time of the operator in turning out the wheels.

Andrew Campriello received $200 for an improvement in the welding of steel cases for enclosing electric equipment aboard cargo ships. This new method will save approximately 3000 man-hours a year.

Electric Utility Coal Consumption

ELECTRIC utility power plants consumed 5,942,748 t. of coal in September, 1942, according to the report of the Federal Power Commission in its monthly publication. The Commission also reported that the coal stocks of electric utility power plants as of October 1 were the highest in history, being 65.7 per cent over the same date last year.

Of the total consumption of coal, 5,685,756 t. were bituminous and 256,992 t. were anthracite. Fuel oil consumed during September totaled 1,426,381 bbl. compared to 1,348,845 bbl. in August, an increase of 5.7 per cent. Gas consumption in September amounted to 21,667,095 M.C.F. compared to 23,847,148 M.C.F. during August, a decrease of 9.1 per cent.

W. R. Whitney Awarded John Fritz Medal

WILLIS RODNEY WHITNEY, well known chemist, engineer, inventor, author and educator, has been awarded the 1943 John Fritz Medal, America's highest engineering award, "for distinguished research, both as an individual investigator and as an outstanding and inspiring administrator of pioneering enterprise, co-ordinating pure science with the service of society through industry." The award is conferred jointly by a board composed of four representatives of four national societies, the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, and the American Institute of Electrical Engineers.

Dr. Whitney is best known for his work in connection with the creation and development of the General Electric Research Laboratory and for his many scientific papers which have been published in technical journals.

Maintenance Program for Serving Industry

TO KEEP PRESENT facilities in industrial and central station plants at peak production, a new maintenance program stressing fewer, shorter and longer-lasting repairs has recently been set up by the Westinghouse Elec. & Mfg. Co. according to H. R. Meyer, manager maintenance sales section. Highlights of the program are regularly scheduled customer contacts for the purpose of making necessary inspections, inventories, field service, and repairs. Maintenance sales engineers will be available to help determine renewal parts requirements and to assist in setting up an electric apparatus system whenever conditions warrant.

Anticipating the wartime need for a well-organized customer-maintenance program, a department known as maintenance sales was set up in December 1941. It consists of a group in each district sales office to assist the salesman in making sure that renewal parts are provided to take care of run-of-mine maintenance work, with emphasis on speedy action to get the machine back on the line should a breakdown occur. As part of the new organization, 34 Westinghouse repair plants located at strategic points throughout the country are completely equipped with the necessary facilities and personnel for rebuilding, repairing, and testing Westinghouse products.

Power Plant for Russia

LEND-LEASE Administration, 515 Twenty-second St., N.W., Washington, D. C., has concluded agreement with Ebasco Services, Inc., 2 Rector St., New York, N. Y., consulting engineer, a subsidiary of Electric Bond & Share Co., for the design and construction of a new steam-electric power plant for shipment to Russia, to be erected, it is understood, in the Ural district. Plant will have a rated capacity of 100,000-kw., divided into four 25,000-kw. generating units, with high-pressure boilers and auxiliary equipment. Entire plant is estimated to cost over $13,000,000 and is scheduled for completion in about 18 mo. All equipment will be manufactured and assembled in the United States. As each of the four units is ready for service, it will be shipped to destination, where final erection will be carried out at once.

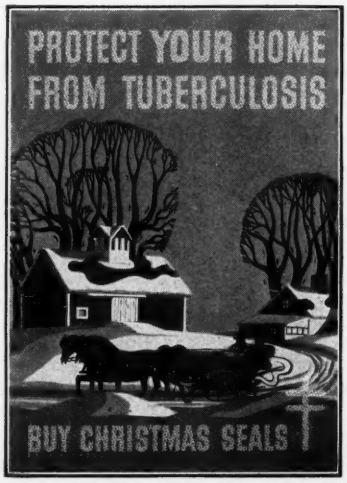
Hydroelectric Plant In Georgia

OFFICE of Chief of Engineers, United States Army, Washington, D. C., has plans maturing for new power dam and hydroelectric power development on Etowah River, Georgia, to be known as Allatoona Dam project. As now designed, work will include a concrete dam structure about 1120 ft. long and maximum height of 184 ft., with concrete grated spillway controlled by seven crest gates, each about 30 by 45 ft. in size. The hydroelectric generating station will be equipped for an initial rating of 66,000 kw., divided into two 33,000-kw. hydraulic turbines and electric generator units. The station will be designed to provide for installation of a third generator of like size at a later date. Project will include transmission lines, power substation and switching stations, with auxiliary operating structures, and is estimated to cost close to $10,000,000.

Welded Pipe Line for Oil Transmission

THE Bayou Pipe Line System, Inc., care of the Shell Pipe Line Corp., Houston, Tex., recently organized by Shell and five other oil companies in the Texas area, has plans and surveys in progress for a new welded steel pipe line from the Houston-Texas City district to Baton Rouge, La., close to 300 mi., for oil transmission. The new line will extend from Baytown to Port Neches, Tex., and thence to Baton Rouge, with a number of feeder pipe lines from refineries of the different companies in the coastal area. The Baytown-Port Neches section will be constructed of 8-in. pipe, and main line from that point to Baton Rouge, 10-in. Project will include a series of pumping stations at points along route for booster service, providing an estimated carrying capacity of 60,000 bbl. per day. Control stations and other operating facilities will be provided at different intervals. At the Baton Rouge terminus, connection will be made with the pipe line system of the Plantation Pipe Line Co., which extends from that point to Greensboro, N. C., and which recently has secured Federal permission to extend its lines to Richmond, Va. Construction of new Texas line is scheduled to begin at early date, utilizing available reconditioned steel pipe from other lines not essential at present time. It is estimated to cost approximately $7,000,000, which will be provided by the affiliated companies. These, in addition to Shell company noted, include Humble Pipe Line Co., Texas Pipe Line Co., Pure Oil Transportation Co., Pan-American Pipe Line Co., and Crown Central Pipe Line & Transportation Corp., all of Houston. Construction and operation of the new line will be under direction of the Shell company.

(Continued on page 162)



CAUSES OF TURBINE OIL EMULSIONS AND CORROSION

AND HOW NONPAREIL TURBINE OIL HELPS PREVENT THEM

Turbine oils that do a good job of preventing corrosion usually sludge pretty quickly. And, vice versa, a turbine oil that's relatively sludge-free is much more likely to permit corrosion.

WHAT MAKES OIL AND WATER MIX?

An emulsion, which is a mixture of oil and water, is usually caused by one of two things, or both. No. 1 is dirt in the oil such as dust and other foreign materials which get into the oil during handling and operation. No. 2 is something in the oil itself—unstable hydrocarbons, asphaltenes and organic acids, say the chemists, are the most common. These help make sludge. What is desirable in a turbine oil is good demulsibility—the ability to separate readily from water.

WHAT CAUSES CORROSION?

Turbine oils don't cause corrosion. Corrosion is caused by *water*, if the turbine oil *permits* it. A turbine oil that doesn't wet the metal and stick to it, may let water push it off the metal surface. That's when rust starts. So the thing an oil needs is ability to wet the metal—wet it with oil, that is, and stick to it.

WHICH DO YOU WANT—DEMULSIBILITY, OR CORROSION PROTECTION?

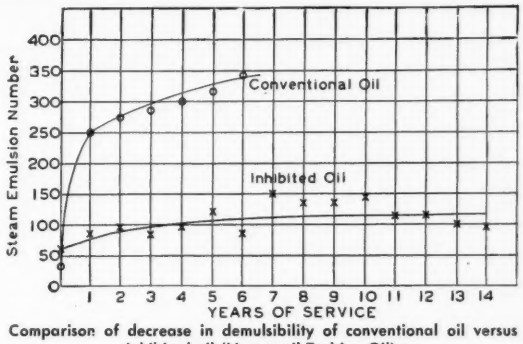
There's nothing hard about making an oil that will stick to metal. Ordinary black oil does a swell job. Paraffine oil with a little lard oil added does an outstanding job of wetting metal and sticking to it. But—and here's the trouble—these oils that stick to metal so well do not separate readily from water. They mix—and sludge starts.

There's been a lot of talk lately about adding a little of the old oil to new oil, to prevent corrosion. The old oil has higher acidity than new oil and is more likely to stick to metal. But with that method you simply gain rust protection at the expense of sludging.

Most oils have been a compromise between good demulsibility and good wetting ability. Refiners have had to make an oil that was highly demulsible, and hope for the best so far as corrosion was concerned; or to make an oil that gave good rust protection, and ask that it be changed or treated when its acidity rose and sludging was threatened.

HERE IS A WAY OUT OF THE DILEMMA

Some years ago, Standard Oil research men found a way out of the dilemma. They made a highly refined oil that separated readily from water. Just to make sure that it wouldn't sludge, they added a patented inhibitor—a chemical which keeps the acidity down.



Comparison of decrease in demulsibility of conventional oil versus inhibited oil (Nonpareil Turbine Oil).

So far, so good. But what about rust? Rust, you remember, occurs because oil lets water push it off the metal. We need an oil that will really wet the metal, and stick to it. This fine, high-grade non-sludging oil alone wouldn't do that as well as some other oils.

So they developed a corrosion inhibitor, which makes this non-sludging white oil wet metal, and stick to it. This inhibitor has been added to Nonpareil Turbine Oil since 1927.

WE GUARANTEE NONPAREIL TURBINE OIL IN WRITING

To men who know turbine oil problems, it seems unbelievable to get a turbine oil that is superior *both* in freedom from sludging and in prevention of corrosion. To assure them that Nonpareil is really something out of the ordinary, we issue a signed guarantee for each installation.

The best way to forecast sludging is by a rise in acidity. So we say, watch the acidity of your oil. (In fact, we watch it for you, by regular sample analysis.) If, says our written guarantee, the neutralization number rises beyond 0.15 mg/KOH gm., when the temperature of the oil from the bearings has been kept below 170° F., we will cheerfully replace the entire batch of oil.

Proof enough, isn't it? But here's more. Right now, 640 turbines are operated on Nonpareil Turbine Oil. Many of them are the second and third turbines in the plant on Nonpareil. Many have been operating 10, 12, 15 years on the *same batch* of Nonpareil, and the rest of them will be operating that long and longer, in a few more years. We guarantee Nonpareil Turbine Oil for the life of the turbine. And that is usually pretty long, especially when it runs on Nonpareil.

Drop us a card, or, if you're in the Middle West, phone the nearest Standard Oil Company (Indiana) office for a turbine oil specialist. If you are technically minded, ask for our Engineering Bulletin No. TN-571 on Turbine Lubrication with Nonpareil Turbine Oil.

OIL IS AMMUNITION . . . USE IT WISELY

STANDARD OIL COMPANY (INDIANA)

LUBRICATION ENGINEERING • • LUBRICATION ENGINEERING • • LUBRICATION ENGINEERING • • LUBRICATION

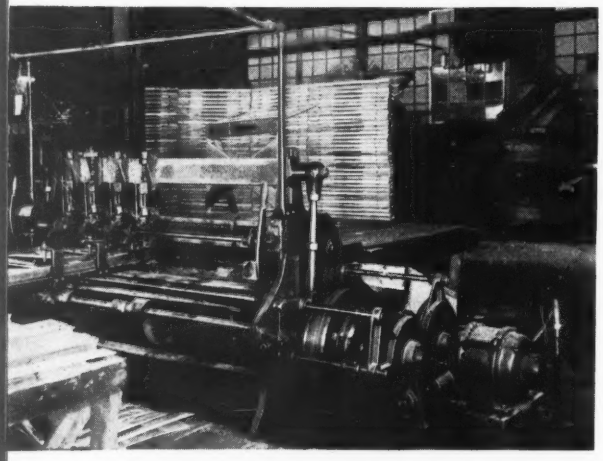
...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATI

HOW TO SAVE
MAINTENANCE MATERIALS AND MANPOWER

Your plant is one in a million if the scarcity of manpower and replacement parts aren't problems. It's one in many hundreds of plants if better lubricants and better lubricating methods can't help you save on one or both of these maintenance items. And here's how to find out if you can save:

Pick out equipment on which you have made replacements recently—where bearings failed or where oil systems or gear cases became fouled. Let a Standard Lubrication Engineer see if he can find the cause of the trouble. Here's a typical example:

The operator of the machine (below) found that the grease used in the clutch mechanism left a resinous



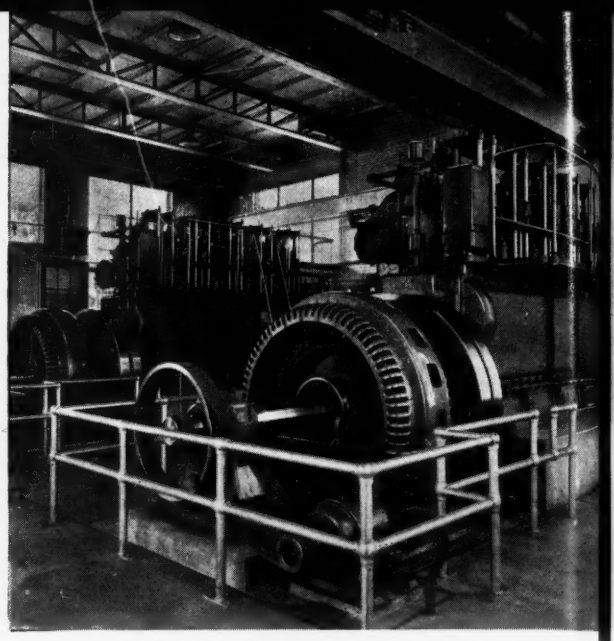
Monthly cleaning of clutch cases on this box stapling machine was eliminated by changing to Superla Grease.

deposit. In spite of the fact that the case was cleaned monthly—a waste of maintenance and machine time—clutch rings showed signs of wear. But there might be an even greater delay if clutch rings had to be replaced.

The problem was given to a Lubrication Engineer who analyzed operating conditions and recommended a grease that would meet the conditions without separating.

Superla Grease, which he recommended, shows no signs of forming deposits in the clutch case after six months of operation. Clutch ring wear is greatly reduced, and the operator has stopped worrying about clutch failures.

This is the advantage of getting a Standard Lubrication Engineer's help. He can match the product to the job. It eliminates time-taking experiments.



KEEP DIESELS ON THE LINE WITH LESS CLEANING...LESS REPAIRING

NONPAREIL DIESEL OIL

Repairs were less than $10 last year on each of the Diesels in a Missouri municipal light plant, pictured above. One engine gave over 6,400 and the other 7,700 H.P. hours per gallon of lubricating oil. Moreover, Nonpareil has been used for three years without a sign of sludging or ring sticking.

Records like this for low maintenance and low oil consumption mean a lot in times like these when conservation of labor and parts becomes increasingly important. They indicate what you can expect.

Test Nonpareil Diesel Oil in your engines. Prove just how clean and trouble-free your Diesel operation can be. A Standard Lubrication Engineer will help you make the test.

HERE'S WHERE YOU'LL FIND A STANDARD OIL ENGINEER

Call any local Standard Oil Company (Indiana) office in the middle western states listed below, or 910 South Michigan Ave., Chicago, Illinois. In Nebraska, write Standard Oil Company of Nebraska at Omaha.

COLORADO • ILLINOIS • INDIANA • IOWA • KANSAS • MICHIGAN
MINNESOTA • MISSOURI • MONTANA • NORTH DAKOTA • WYOMING
SOUTH DAKOTA • WISCONSIN

OIL IS AMMUNITION . . . USE IT WISELY

STANDARD OIL COMPANY (INDIANA

. . a job for experts

Board Composed of 14 Falstrom Standard Unit Steel Panels. Ivory Lacquer Finish—Stainless Steel Trim

STEEL PANELS BY FALSTROM

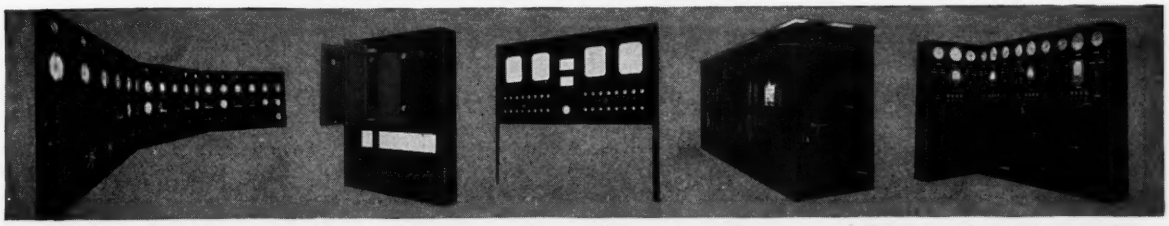
THE construction of steel panels for an instrument board as large as this impressive installation certainly is a job for experts. Experts to design the system . . . to appoint the contractor . . . to select instruments and controls . . . and finally, experts to build the steel panels.

Falstrom has been awarded thousands of panel jobs, large and small, because of its reputation of service in this field . . . a service which includes proper interpretation of customers drawings . . . recommendations for better or less expensive fabricating methods . . . precise manufacture . . . faultless surface finish . . . and, now very important, reasonable deliveries.

For emergency defense construction, more now than ever, you must be sure to build right and to build fast. Falstrom can help you meet those delivery dates on all types of steel switchgear mounting or enclosing structures as well as other fabricated steel parts. For quotations, send your blueprints. Write for free catalogs to Falstrom Company, 77 Falstrom Court, Passaic, New Jersey.

STEEL INSTRUMENT PANELS—CUBICLES—CABINETS—SWITCHGEAR ENCLOSURES FOR EVERY INSTALLATION NEED.

Meet Us At Booth 513 At The Power Show

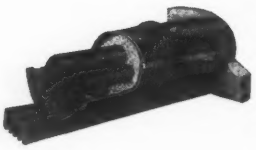


FALSTROM

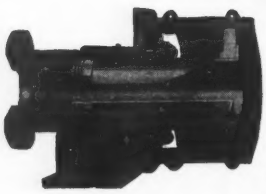
HOW TO KEEP VITAL STEAM LINES AT TOP EFFICIENCY FOR THE DURATION

And for Years Afterward

4 VALUABLE ADSCO SUGGESTIONS



1 For underground lines use sectional ADSCO-Bannon Tile Conduit with base drain. Insulated with ADSCO Filler Insulation, a "Fiberglas" product, it provides a permanent installation at low first cost and high thermal efficiency.



2 Determine expansion and contraction of the pipe line carefully, allowing an ample factor of safety. Use ADSCO Piston-Ring Expansion Joints. They can be unpacked and repacked under full operating pressure without interruption to service.

3 Install pipe alignment guides and pipe anchors made by ADSCO. They are essential to avoid undue strain on fittings and expansion joints; good assurance against future line failure.

4 Know your actual steam consumption for heating or process purposes. Install Condensation or Steam Flow Meters. ADSCO can furnish either kind to help you detect steam losses and improve utilization.

● WRITE FOR CATALOG 35E

AMERICAN DISTRICT STEAM COMPANY · NORTH TONAWANDA N. Y.

ADSCO HAS BEEN BUILDING "UP-TO-DATE" STEAM LINE EQUIPMENT *for over 60 years*

ASA Announces New Standards

STANDARD governing letter symbols for mechanics of solid bodies have been approved and published by the American Standards Association. With 68 letter symbols approved to indicate such concepts as angular acceleration, circular frequency, factor of safety, normal strain, wave length, and the like, the new standard also cites general principles of letter symbol standardization governing manuscripts, subscripts, superscripts, unlisted magnitudes and typography.

The new standard was prepared by the ASA Sectional Committee on Letter Symbols and Abbreviations for Science and Engineering, under the joint technical leadership of the following organizations: the American Association for the Advancement of Science, the A.I.E.E., the A.S.C.E., the Society for the Promotion of Engineering Education and the A.S.M.E.

Also three governing specifications for steel for stationary boilers, boiler rivets and pressure containing parts have been approved by the ASA. The first standardizes specifications covering carbon-steel plates up to 4 inches, inclusive, in thickness, for stationary boilers and other pressure vessels; the second set of specifications covers rivet steel and rivets for use in such boilers, and the third covers carbon-steel castings for valves, flanges, fittings, and other pressure containing parts for high-temperature service.

The specifications, which were developed under the leadership of the A.S.T.M., apply to such aspects as: process, heat treatment, temperature control, chemical composition, ladle and check analysis, tensile and bending properties, tests, workmanship, finish, marking and inspection.

Mix Oil and Coal to Avert Oil Shortage

MIXING of oil and coal to produce a liquid fuel suitable for use in many industrial oil-burning furnaces has been suggested by the Bureau of Mines as a possible means of alleviating the current fuel oil shortage in the Eastern Seaboard states. On the basis of a preliminary investigation the Bureau believes that many industrial furnaces could utilize this oil-coal fuel without material alterations in boilers and burners and estimates that 30 to 35 per cent of the oil ordinarily consumed would be saved in certain types of furnaces.

The chief problems in blending oil and coal into a suitable fuel are keeping the coal particles from settling to the bottom of the tank and preventing the mixture from clogging tubes and burners during combustion.

In preparing a composite fuel, the Bureau recommends using a bituminous coal with low ash and high fusion temperature. Grinding as fine as possible will help to obtain rapid combustion.

The Bureau recommends a survey of oil-burning plants on the Eastern coast to determine the following facts:

1. If they already have the necessary equipment to burn coal.
2. If coal-burning equipment could be installed without rebuilding the furnace and boiler.
3. If an oil-coal fuel could be used without seriously reducing the boiler rating.
4. If the boiler would be plugged by the ash from oil-coal mixtures.

Northern States Plant Expansion

THE Northern States Power Co., Minneapolis, Minn., has begun work on foundations for proposed addition to the High Bridge steam-electric generating station on Mississippi River at St. Paul. Plans are nearing completion for superstructure and award for this construction is scheduled to be made at early date. The new building will be used for expansion in plant capacity, providing for the installation of a new 50,000-kw. turbo-generator unit, high-pressure boiler and auxiliary equipment. Orders for primary equipment have been placed and contracts for required accessory apparatus will be awarded as work progresses on project. Completion is scheduled in 1943, with estimated cost of development placed at $5,000,000. Public Utility Engineering & Service Corp., 231 South La Salle St., Chicago, Ill., is consulting engineer.

Boiler Plants for Hospital Project

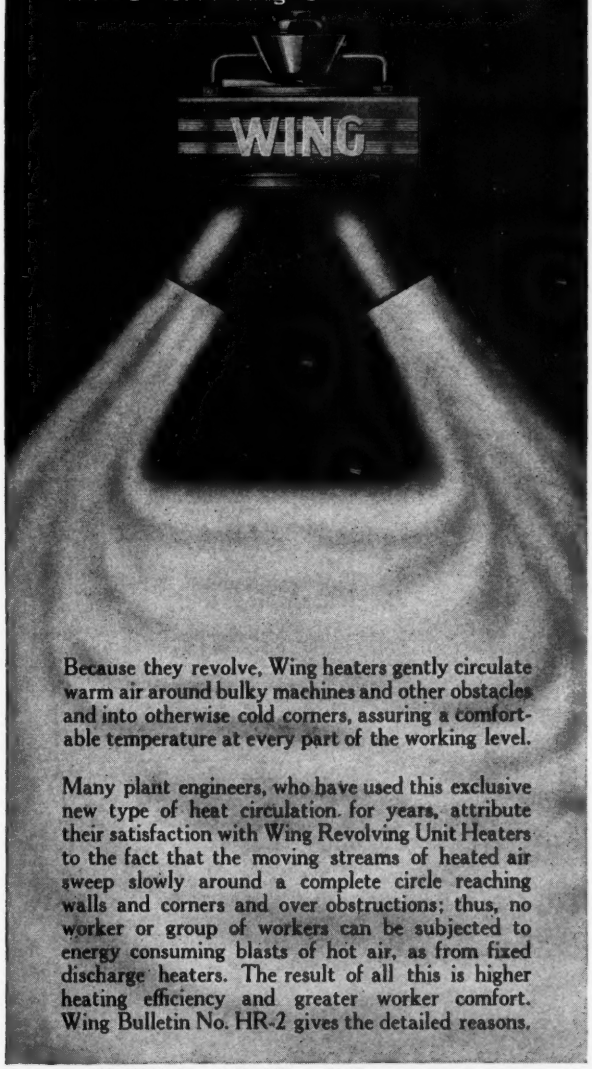
THE FEDERAL WORKS AGENCY, Washington, D. C., has authorized an appropriation of $3,207,500 for construction of new hospitals and additions to present institutions in the District of Columbia and Metropolitan Area, the latter including Arlington County, Va., Alexandria, Va., and Montgomery and Prince Georges Counties, Md. Three new hospitals and nurses' homes will be constructed in the last noted districts; one will be located in Prince Georges County and will cost about $612,000; another in

Pioneered WING Products

WING pioneered and developed the ceiling-suspended, light-weight unit heater, projecting the heated air vertically downward, over 22 years ago. Every improvement since then in this type of industrial plant heating, including the new Revolving Heaters, has been inaugurated by WING engineers.

WING pioneered and developed the individual forced draft blower for boiler plants nearly 40 years ago. In this field, WING engineers were constantly ahead of the rest of the industry, as in their pioneer work in the development of the Axial Flow Blower over 5 years ago.

WING Revolving UNIT HEATERS



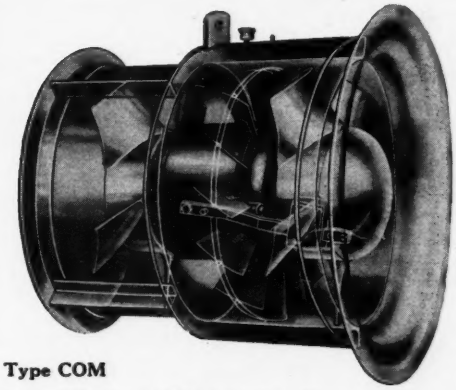
Because they revolve, Wing heaters gently circulate warm air around bulky machines and other obstacles and into otherwise cold corners, assuring a comfortable temperature at every part of the working level.

Many plant engineers, who have used this exclusive new type of heat circulation for years, attribute their satisfaction with Wing Revolving Unit Heaters to the fact that the moving streams of heated air sweep slowly around a complete circle reaching walls and corners and over obstructions; thus, no worker or group of workers can be subjected to energy consuming blasts of hot air, as from fixed discharge heaters. The result of all this is higher heating efficiency and greater worker comfort. Wing Bulletin No. HR-2 gives the detailed reasons.

WING AXIAL FLOW BLOWERS

Type EMV
Type EMB

WING Axial Flow Blowers are being used on battleships, cruisers, destroyers, aircraft carriers, mine layers and sweepers, seaplane tenders and many other types of vessels. Types EMV and EMD are single stage blowers for static pressures up to 3" at moderate speeds. Type EMD is a remarkably compact blower and is furnished with adjustable damper blades.



Type COM

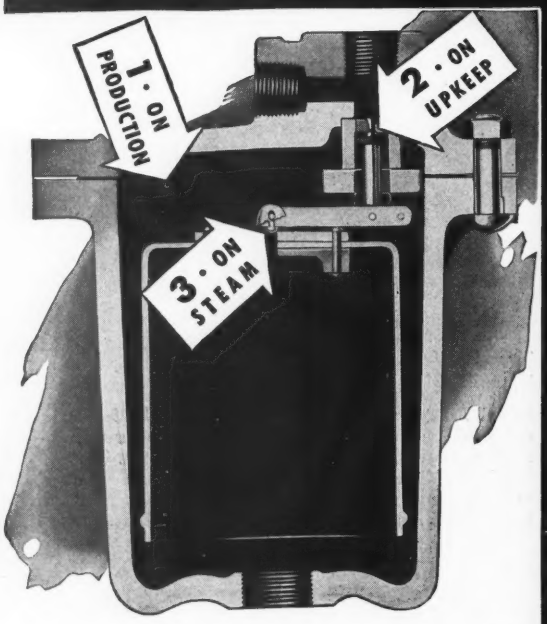
The WING Type COM Axial Flow Blower is a two-stage blower for static pressures up to 7". These pressures are obtained even at the moderate speeds of standard commercial motors. Type COM Blowers are equipped with adjustable built-in control vanes and may be controlled manually or automatically. Five years of highly satisfactory service in marine and industrial applications are the best answer to the value of WING Axial Flow Fans in forced draft or ventilating work.

L. J. WING MFG. CO., WEST 14th STREET & 7th AVENUE, NEW YORK, N. Y.

WING TURBINE BLOWERS · FOG ELIMINATORS · PROCESS HEATERS · MOTOR DRIVEN BLOWERS · VENTILATING FANS · REVOLVING UNIT HEATERS · STEAM TURBINES · SHIP VENTILATORS · FIXED DISCHARGE HEATERS · EXHAUSTERS

PIPEWRENCH PETE SAYS:

THESE 3 SAVINGS MAKE SENSE TO ME!



1 Cut down spoilage, keep production UP! Strong's positive-acting, extra-capacity traps often increase output amazingly — always keep costs DOWN!

★ ★ ★

2 Strong traps just don't seem to wear out! That special, wear-resisting Anumetl makes STRONG valves and seats last eight times as long as even Strong's former parts. You get a full year's guarantee against valve leakage or any replacement.

★ ★ ★

3 How much can positive opening and tight closing of your traps save on steam? Get these savings with STRONG'S *anti-balancing* device! Valve opens wide to discharge condensate, then closes tight—no dribbling! Positive action, plus Anumetl valves and seats can easily save more than the trap costs, in steam alone.

★ ★ ★

MONEY-BACK GUARANTEE! Test Strong traps on your toughest jobs. If not satisfied at the end of 90 days, return them, and your money will be refunded.

HOW DO YOU SIZE STEAM TRAPS? An easy method, plus valuable information on installations, etc. Get Catalog 63-PE2

STRONG, CARLISLE & HAMMOND COMPANY
1392 WEST THIRD ST., CLEVELAND, OHIO

STRONG
STEAM TRAPS

Montgomery County, to cost $665,000; and the third, an addition to hospital at Alexandria, to cost $712,000. Boiler plants will be constructed for central-heating service at these different units, with complete underground steam distribution pipe lines and other facilities. Also, electric light and power systems, with substation units, switchboard and control rooms, conduit lines, etc. Similar facilities will be required in the new hospital to be constructed at Sixteenth and Edison Streets, Washington, to cost $610,000. The appropriation of $69,500 for extensions in the Gallinger Hospital, Washington, includes the remodeling and improving of present power plant, with installation of equipment for increased capacity. Entire program is scheduled to be carried out at an early date.

Expansion in Dresser Power Plant

THE Public Service Co. of Indiana, Indianapolis, Ind., has plans maturing for proposed addition to Dresser steam-electric generating station at West Terre Haute, Ind. Work on the foundations has been in progress for a number of weeks. The new unit will be of brick and reinforced-concrete, 2-story type, about 77 by 151 ft., and will be used for the installation of equipment for large increased capacity. This will include a 50,000-kw. turbo-generator unit with accessories and boiler room equipment. Switch-yard at plant will be enlarged and extensions made in transmission lines leading from this central station. Completion is scheduled late in 1943. Entire project is reported to cost in excess of $4,500,000. Sargent & Lundy, Inc., 140 S. Dearborn St., Chicago, Ill., is consulting engineer.

OBITUARIES

William Salt, for many years head of the Service Department of the De Laval Steam Turbine Co., Trenton, N. J. died on October 31, 1942. He had been associated with the company for more than 40 yr.

David W. Haering

DAVID W. HAERING, President of D. W. Haering and Co., Inc., died suddenly on Oct. 30 after a 2-day siege of pneumonia. Mr. Haering was born in Chicago on February 3, 1908. He attended the Chicago grammar schools, the Austin High School, and was graduated from the University of Illinois in 1929 with a Ph. C. degree.

D. W. Haering developed the company through a period of depression from a one-man organization into a well established corporation having headquarters at 205 West Wacker Drive, a factory, control, and research laboratories in Chicago, and technical offices in the principal industrial cities of the United States.

Mr. Haering was the president and technical director of the company bearing his name and was also an authority on scale and corrosion. The company acts as water consultants for many large industrial corporations. Under his direction the research laboratories of the company discovered and developed many organic glucosides for the control of scale and corrosion in aqueous systems. The engineering department invented and patented a proportioning machine using the Haering liquid piston principle for proportioning liquids into liquids or gases. This machine is actuated by the velocity of the liquids flowing through a pipe, and does not require any outside source of power.

Mr. Haering lectured before most of the technical societies in this country and wrote nearly a hundred articles for scientific and business papers. His book, "Organic Methods of Scale and Corrosion Control", is in its fifth revised edition. He also edited the house organ, "H-O-H Lighthouse", a quarterly publication issued by the company.

In June of this year Mr. Haering, through his research laboratory, announced the successful solution of the steam and return line corrosion problem by the dispersion of organic chemicals directly into high-pressure steam lines.

Mr. Haering was a member of many technical societies, including the American Chemical Society, the American Society for Testing Materials, the National Association of Power Engineers, the American Pharmaceutical Association, the Illinois Pharmaceutical Association, the American Association for the

The Secret of Trouble-Free Stoker Performance...

OTHER "F & E" FEATURES

Interval Timer Governor (patented). Permits extremely accurate regulation of coal feeding rates; provides Full-Stroke, Full-Speed Ram Action at all times. *Sliding Bottom Retort.* Assures perfect fuel distribution. *Removable Ram Case Liner.* Reduces maintenance costs. *Ram Safety.* Entire mechanism stops should foreign matter be fed in with coal. *Exterior Fuel Bed Regulator.* Permits outside adjustment to fuel bed in event of change in quality of fuel.

The power plant is the heart of the stoker. Its design, its proved performance and its ability to "take it" are the factors that control the success of the entire stoker installation. Economy, dependability and maintenance depend upon it!

"F & E" Stokers feature the Electro-Hydraulic Drive . . . the drive that engineers say is the most positive method of power transmission. The entire mechanism has only 5 moving parts . . . sealed and operating in a bath of oil. There are no gears or ratchets to wear out, no pipes, valves or fittings to break. It is amply protected against breakdowns.

No wonder "F & E" Underfeed Stokers enjoy an enviable performance record in many hundreds of power plants in every field of industry.

F&E STOKERS

FOR INDUSTRIAL AND COMMERCIAL BOILERS REQUIRING FROM 1,000 TO 40,000 LBS. OF STEAM PER HOUR

Manufactured by

FLYNN & EMRICH COMPANY

Established 1842

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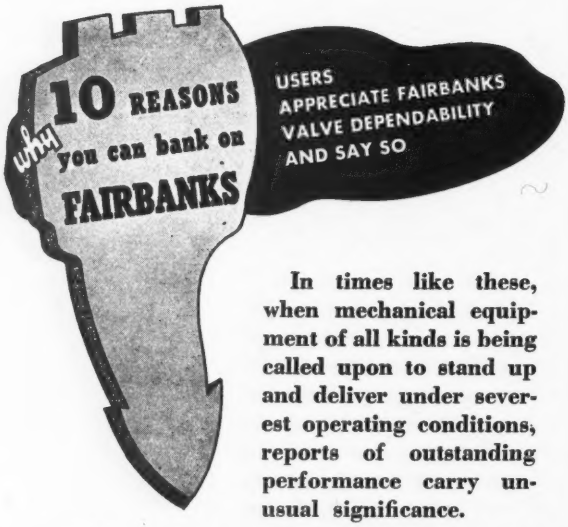

In times like these, when mechanical equipment of all kinds is being called upon to stand up and deliver under severest operating conditions, reports of outstanding performance carry unusual significance.

That valve users do not hesitate to acclaim Fairbanks Valves for dependability under present day conditions is evidence that maximum service with minimum maintenance is being realized. The high quality of Fairbanks Valves which assures dependability is being demonstrated and confirmed by experience in countless busy plants. Such performance leads to the simple conclusion that it's good plant practice to "Bank on Fairbanks."

And you can "bank on your Fairbanks" distributor for dependable service, too. If you haven't his name we'll gladly advise you.

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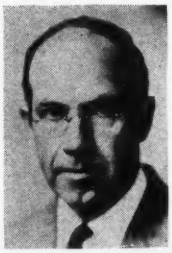
Advancement of Science, the New York Chemists' Club, the Chicago Section of the American Chemical Society, the American Society of Refrigerating Engineers, serving as President in 1933, the National Association of Practical Refrigerating Engineers, the Practical Refrigerating Engineers Association, the Universal Craftsmen Council of Engineers, the Chamber of Commerce of the State of New York, the Electrochemical Society, the American Waterworks Association, and he was an Associate of the American Society of Mechanical Engineers. In 1940 he was appointed a Life Member of the United States Flag Association. He is survived by his widow, father and two sisters.

Nelson J. Darling



NELSON J. DARLING, manager of the West Lynn and River Works of General Electric Co., died October 26 at Beach Bluffs, Mass., at the age of 58.

Born in Toronto, Ontario, Mr. Darling graduated from Cornell University in 1907 and joined the G-E test course as a student engineer. In 1909 he went to the Panama Canal Zone with the Dodge and Day Co. to assist in the installation of electrical apparatus. He returned to the General Electric Co. the same year, serving in the railroad engineering department until his transfer to the Erie, Pa., plant.

During World War I, Mr. Darling was active in the design of machines for the manufacture of turbines for Navy destroyers, 12-in. shells for the British government, 3-in. shells for the Russian government, and gasoline-electric cars and electric locomotives. In 1918 he was appointed assistant manager of the Erie plant, in 1922 manager of the River Works at Lynn, Mass., and in 1935 became manager of the West Lynn works in addition to his duties at the River Works.

L. W. W. Morrow

LESTER W. W. MORROW, 54 yr. old, professor of engineering administration at Rutgers University and former managing editor of the Electrical World, died November 15.

Prof. Morrow was graduated in 1907 from Marshall College and was instructor in electrical engineering at Cornell University from 1911 to 1913. He became professor at the University of Oklahoma and was director of its school of engineering until 1918.

He was managing editor of the Electrical World from 1923 to 1937. In 1926 he was a delegate to the World Power Conference in Berlin and in 1937 he became manager of the fibre glass division of the Corning Glass Works. He had been at Rutgers since 1941.

Prof. Morrow was widely known in electrical engineering circles. He had been a director of the American Institute of Electrical Engineers and was vice-president of the Thomas Alva Edison Foundation, a member of the American Institute of Electrical Engineers, and a member of the American Society of Mechanical Engineers and of the American Electrochemical Society.

New Engineering Books

Midwest Power Conference for 1942. 216 p., 6 by 9 in., paper cover. Midwest Power Conference, 3300 Federal St., Chicago, Ill. Price $2.00.

Proceedings of this conference, sponsored by Illinois Institute of Technology in conjunction with other midwestern universities and Chicago sections of the national engineering societies, include all papers presented at the conference. Those most likely to be of interest to power plant men are: Prevention of Steam Losses and Fuel Wastes, by V. G. Leach of Peabody Coal Co.; Controlled Forced-circulation Boiler at Montaup Electric Co., by F. H. Rosencrantz of Combustion Engineering Co.; Maximum Output from Existing Boiler Plants, by E. G. Bailey of Babcock and Wilcox Co.; Field Experience with Lightning, by Chas. F. Wagner of Westinghouse Elec. & Mfg. Co.; Lightning Proof Line Design, by A. C. Monteith of Westinghouse Elec. & Mfg. Co.; Power in Flour Milling, by A. R. Ulstrom of Cereal Engineering & Construction

...INSPECT YOUR INSULATIONS REGULARLY...

NUMBER 6 in a series of messages to American industry devoted to conserving heat, improving operation and increasing production by . . .

GETTING THE MOST FROM YOUR THERMAL INSULATIONS . . .

As the periodic rounds of the watchman safeguard both plant and production, so the regular inspection and maintenance of your heat insulations will insure against the encroachment of costly heat losses. Even the best of insulations can suffer damage from service hazards and abuse. Unless the little losses are found and checked, totals can soon reach astonishing proportions.

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★ EHRET'S 85% Magnesia and many other Ehret heat insulating materials are fully treated, both as to selection and application, in the 176-page Ehret Heat Insulation Handbook. It will be furnished, without obligation, to those interested in getting the most from their thermal insulations. Write today for your copy of Handbook B 212.

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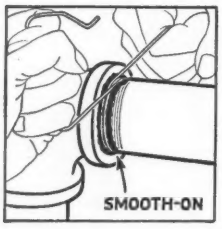
WORN PIPE FITTINGS

How to Make them USABLE with SMOOTH-ON

Today, it is essential to salvage used pipe and fittings for re-use whenever possible. You may find some fittings to have worn, corroded, or battered threads, but even such fittings can be made fully serviceable by means of Smooth-On No. 1.



This iron repair cement fills all voids between the threads, and expands as it hardens to form a lastingly tight joint, even under high temperatures and pressures. Smooth-On can be effectively used in this manner even if the fitting is a size larger than the pipe or nipple as in the illustration below.

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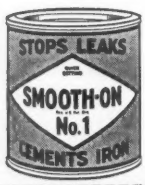
Simple, concise instructions for these and hundreds of other material-saving repairs to plant equipment and pipe lines are given in this 40-page practical repair manual. A wartime necessity in every plant. Your copy sent FREE if you fill in and return the coupon.



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Co.; Water Problems in Small Power Plants, by Everett P. Partridge of Hall Laboratories, Inc.; Silting of Water Power Reservoir, by E. W. Lane of State University of Iowa; Cost of Power in the United States, by L. A. Doggett of Pennsylvania State College; Preventing and Extinguishing Electrical Oil Fires, by H. W. Erles of Public Utility Engineering and Service Corp.; Results from Spreader Stokers, by R. N. Bucks of Studebaker Corp.; Steam Boiler Circulation, by A. A. Markson of Hagen Corp.; Coal Research, by A. W. Thorson of Carnegie Inst. of Technology; Radial Diesels, by E. T. Vincent of University of Michigan; Diesel vs. Steam Locomotives, by Robert Aldag, Jr., of C. B. & Q. R. R.

Charts and illustrations are given as presented by the authors, with text in full.

Engineer's Pocket Book of Tables, Formulas and Memoranda. By F. J. Camm, 490 p., 4 by 6½ in., cloth. Chemical Publishing Co., Brooklyn, N. Y. Price $4.25.

While this compilation gives briefly units of force, energy, power, velocity and electricity, and treatments of mensuration of plane areas, solids, trigonometrical calculations and the like, the major part is concerned with data and tables for design and manufacture of machinery. It should be a convenience for machine designers and builders.

Electric Power Stations, Volume Two. By T. H. Carr. First edition 440 p., 5½ by 8½ in., cloth, illustrated. Published by D. Van Nostrand Co., Inc., 250 Fourth Ave., New York, N. Y. 1941. Price $9.00.

As was pointed out in our review of Vol. I of this book on page 154 of the Dec., 1941 issue, it is interesting to us here in America, that even in war-torn England, engineers engaged in the generation of electric power can find time to write books on the subject. Mr. Carr is an Englishman and his book reflects English practice, but the underlying principles of power station design and operation have no nationality and this book should prove as useful in this country as it will be across the Atlantic. Indeed, the slight variations in practice should be of particular interest to us here.

The first volume was concerned largely with preliminary considerations and a detailed treatment of boiler house design and operation, carrying the subject up to a discussion of turbines. This present volume begins where the first left off, with Chapter 10.

The chapter headings are as follows: 10, Alternators. 11, Condensing Plant. 12, Feed Heating and Water Treatment Plants. 13, Transformers and Reactors. 14, Switchgear. 15, Cabling and Cables. 16, Lubricating, Insulating and Fuel Oil. 17, Station Auxiliaries. 18, Electrical Protective Equipment. 19, Station Lighting. 20, Commissioning and Testing of Plant. 21, Organization. 22, Station Costs. 23, Fire Fighting and Air Raid Precaution.

14,000 Gear Ratios. By Ray M. Page. 404 p., 8½ by 11 in. Published by The Industrial Press, 148 Lafayette St., New York. Price, $5.00.

This new book contains about 14,000 two-gear combinations and millions of possible four-gear combinations. The tables are presented in both common fractional and decimal forms, and are divided into four main sections, each of which is arranged to facilitate the solution of different classes of ratio and speed problems.

Section 1—Common Fractional Ratios and Decimal Equivalents—This section is composed of 119 separate tables, each complete on one page, with the denominator of the fractional ratio serving as an index. These denominators range from 2 up to 120, inclusive. Each common fractional ratio is followed by its decimal equivalent. For example, the decimal equivalent of 7/27, is in the table having 27 as the denominator. Opposite 7/27 is the equivalent, 0.259,259,259,26.

Section 2—Decimal Ratios, Their Logarithms and Equivalent Pairs of Gears—The tables in this section contain in the first column ratios expressed as decimal fractions. All these decimals are arranged in numerical order from the lowest to the highest, so that any value in the table can readily be located. The decimals are followed by their logarithms in the second column. The third column contains the ratios expressed as common fractions. When a given ratio has two or more common fraction equivalents, all these are given to facilitate selecting required gear sizes.

Section 3—Total Number of Teeth with Equivalent Gear Pairs and Ratios—The tables in this book apply to all gear combinations having tooth numbers up to 120, inclusive.

MEMO

TO... *Those Converting from Oil to Coal!*

DEAR MR. PATRIOT - - -

Have you our Stoker Operating and Maintenance Chart? If you have recently changed from Oil or Gas firing to Coal Stoker firing, in accordance with the expressed needs of Our Country at the moment, you will find this Chart helpful in conserving both fuel and equipment.

While compiled primarily for use with CANTON STOKERS, the information contained on these handy charts is invaluable to the operator of ANY underfeed stoker of similar type. Here, in brief, are the subjects covered in detail . . .

1. COAL . . . the types and sizes to use for best results . . . also combinations for maximum BTU's.
2. STARTING FIRES . . . the complete procedure, from checking boiler to tips on fuel distribution.
3. COAL ADJUSTMENT . . . the proper rates in accordance with type of fuel and load conditions.
4. AIR ADJUSTMENT . . . how best to set, so correct mixture can be achieved.
5. TO CLEAN FIRE . . . how and when to remove ash and clinkers.
6. CONTROLS . . . those employed, their use and care.
7. OBSTRUCTIONS . . . how to deal with foreign materials, which cause damage, in stokers.
8. HOPPER SMOKE . . . reasons why hopper smokes, and how to eliminate it.
9. BOILER DAMPER . . . how to adjust manually, or automatically.
10. CARE AND MAINTENANCE . . . all-over maintenance tips for best stoker results.
11. GENERAL INSTRUCTIONS . . . the way to get maximum economy from a stoker . . . how to make your complete boiler installation do a better job.

CANTON STOKER

If you have not yet made your conversion to Coal, CANTON's *54 sizes and types of Stokers* permit you to select the design best suited to your needs. A brief Summary follows:

54 Types of Stokers and Controls

(1) Vulcan Industrial Ramfeed—For the heaviest industrial loads—18 sizes and types specially designed to suit each application.

(2) Lo-Set Industrial Ramfeed—For medium industrial and heavy commercial jobs—18 sizes and types specially designed to fit each job.

(3) DeLuxe Industrial Wormfeed—For lighter industrial and medium commercial demands—10 sizes and types, built to fit each job.

(4) Standard Commercial Wormfeed — For lighter commercial applications—8 sizes and types offer ample selection.

(5) Canton Synchronized Controls—For Ramfeed and Wormfeed Stokers—for automatically varying coal feed, forced draft and boiler draft to follow steam demand.

THIS IS DATA YOU NEED NOW, SO AS TO GET THE MOST FROM YOUR STOKERS . . . TO PREVENT NEEDLESS WASTE OF FUEL AND PRECIOUS PARTS, WHICH ARE HARD TO REPLACE. SEPARATE CHARTS AVAILABLE FOR WORMFEED AND RAMFEED STOKERS. WRITE FOR YOURS TODAY, SPECIFYING WHICH CARD YOU PREFER.

CANTON STOKER CORP.

Canton, Ohio

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2. Send Ramfeed Stoker Chart .....
3. Send Data on Stokers.....

Boiler H.P. ..... Type.....

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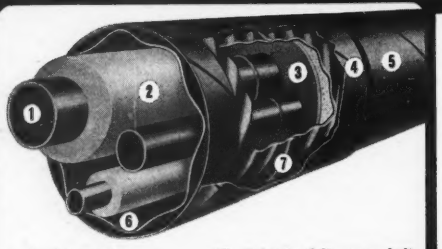
STREAMLINE YOUR STEAM LINES...WITH *ALL-WELDED* INSULATED PIPE UNITS

Welding Connections Between Flanged Units



1—Steam pipe
2—Sectional pipe covering
3—Pipe support
4—Thick strip asphalt applied after welding
5—Asbestos felt over asphalt coated Hel-Cor
6—Air space
7—Butt welded connection

...For Faster Steam Supply!

SPEED on installation of steam lines is of utmost importance in wartime construction. Ric-wiL does most of the work in the factory—so *you* don't have to do it on the job. That saves precious time! And a Ric-wiL job is complete—you don't wait for missing parts or for a great variety of labor in the field!

For a steam-and-watertight connection on both pipe and conduit, use Ric-wiL Insulated Pipe Units with *all-welded* connections, as pictured above. They give a perfect, permanent seal and a joint of maximum strength.

These are totally pre-fabricated, ready-to-install units, ideal for both speed and economy. Structural strength of Hel-Cor spiral conduit exceeds *any normal* service requirements. Units are furnished in 20-foot lengths, for single and multiple pipes, for any kind of steam pipe or insulation desired, for underground or overhead. Can be quickly installed, with minimum trenching, in ANY kind of weather. All expansion loops, conduit fittings, anchors, watertight glands for walls, and other parts can also be furnished ready to install. Write for Catalog "S", showing *all* types of Ric-wiL Conduit construction.

Engineers on War Projects ONLY: Ask on your letterhead for Engineering Manual 420-A.

RIC-WIL CONDUIT SYSTEMS
THE RIC-WIL CO., CLEVELAND O.
Agents in Principal Cities

Section 3 lists, in ascending order, all total tooth numbers from 25 up to 119 + 120, or 239. Below each total number are listed all two-gear combinations equivalent to that total. For example, under "37 Total Teeth" are listed fourteen combinations or pairs of driving and driven gears, each of which has a total of 37 teeth. This section has been arranged for use in selecting "pick-off" or other gears on fixed centers.

Section 4—Numbers and Equivalent Gear Factors—The gear factor table in this section consists of all numbers from 20 to 14,400 that are the product of two factors neither of which exceeds 120. This table is particularly useful in finding gear combinations equivalent to a given numerator and denominator representing a required ratio. For example, if a required

ratio $= \frac{1394}{2162}$, the table shows that $\frac{34 \times 41}{46 \times 47}$ is an equivalent of this ratio expressed in practical gear sizes.

These four main sections are accompanied by typical examples showing how the different tables are utilized in obtaining practical gear combinations for precise timing or speed relationship between driving and driven shafts. The examples not only illustrate the use of the tables, but include methods of factoring and "rounding off" odd decimal ratios in cases where the exact ratio may not be obtainable, but a very close approximation is essential. These examples include the selection of change-gears for helical-gear hobbing, both on machines with and without a differential mechanism. This book of ratios may be applied in designing various types of transmissions, including spur, bevel, helical, and worm gearing. With the aid of these tables, it is possible to solve readily ratio problems that otherwise would be very difficult, cumbersome, or impossible.

Luminescent Coatings. Size 6 by 9 in., 10 pp. Published as a report of Subcommittee No. 43 of the New York Paint and Varnish Production Club. Available from Carl Engelhardt, Brooklyn Varnish Co., 35 Nostrand Ave., Brooklyn, N. Y. Price single copies 10 ct. each; special price on quantity orders.

This is a very complete and concise description of the various luminescent paints and coatings, their known properties and uses at the present time. It includes photo luminescent coatings only and not those containing radioactive materials. It is prepared particularly from the standpoint of the manufacturer, although at this particular time the information is of more or less general interest.

Fluorescent coatings emit light only when activated by black light. Phosphorescent coatings will glow for appreciable intervals after the light source has been extinguished. Phosphorescent coats are of two general types, the first with a high brightness for the first few minutes after excitation and a useful afterglow of about 2 hr. The second type has a relatively low brightness but the afterglow lasts from 2 to 12 hr.

Chart Method of Controlling Quality During Production was published as Standard Z1.3-1942 by the American Standards Association, 29 W. 39th St., New York City. Price 75 ct.

The purpose of the publication is to give a practical and simple method of reducing rejects on quantity produced items which must fall within definite control limits. Four illustrative samples are given in the new standard which show in detail the application of the chart to different products and to aid in applying the control technique to specific manufacturing problems. This is the third standard developed by the A.S.A. Committee on quality control. The first two standards, A Guide for Quality Control, Z1.1-1941, and The Control Chart Method of Analyzing Data, Z1.2-1941, were published by the Association in 1941 in a single pamphlet, the price of which is also 75 ct. a copy.

Typical Analysis of Bituminous Coals. Vol. No. 4. Compiled by the Office of the Bituminous Coal Consumers' Counsel in cooperation with the U. S. Bureau of Mines. 11 pp., size 13 by 26 in., paper bound. For sale by the Superintendent of Documents, Washington, D. C. Price 40 ct.

This book contains complete data and descriptive tables of all rail and river shipping mines in District No. 13. Maps show the location of the mine and tables arranged by seams, by states and by counties give typical analysis and the ash softening temperatures of each mine. District No. 13 covers the south central part of Tennessee, the north-

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"THIS PUMP HOLDS TEMPERATURES WITHIN ±1° F."

UNDER FULLY AUTOMATIC CONTROL

In an eastern public utility station, an Aldrich-Groff controllable capacity "Powr-Savr" Pump has been in almost continuous operation for nearly three years, supplying water for desuperheating steam. Arranged for automatic temperature control, its response is such that "the indicating and recording instruments show a total variation of only 1° F. from the desired temperature". This pump has a variable capacity from 0 to 65 GPM at a constant pump speed of 190 RPM against 350 lbs. pressure and is driven by a 20 HP 1750 RPM constant speed A.C. motor.

Aldrich-Groff Pumps provide for automatic manual control of delivery from zero to full rated capacity at constant pump speed. Rate of delivery is controlled by variation of the length of plunger stroke and power consumption is almost directly to pump delivery. They offer the advantages of feed system simplicity, efficiency and mechanical reliability for the small and medium boiler plant using medium or high steam pressures, and for desuperheater feed service in even the largest power stations.

Write for bulletins and material giving full details, sizes and ratings of Aldrich-Groff Pumps.

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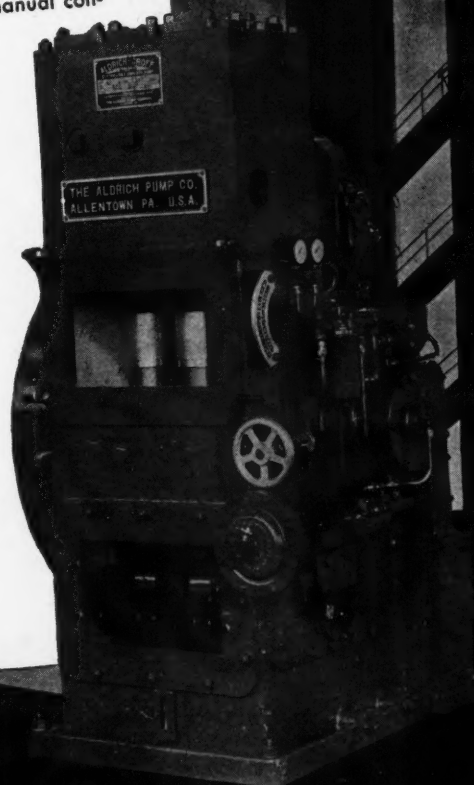
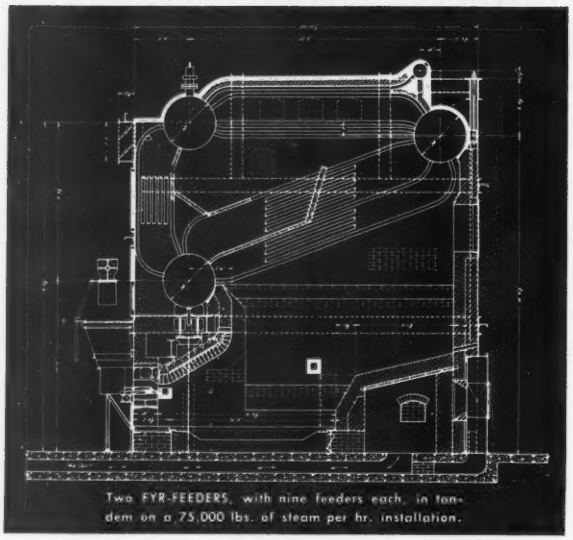


THE ALDRICH-GROFF CONTROLLABLE CAPACITY "POWR-SAVR" PUMP
TRADE MARK

FYR-FEEDER

MULTIPLE SPREADER STOKERS



Two FYR-FEEDERS, with nine feeders each, in tandem on a 75,000 lbs. of steam per hr. installation.

—The Answer to Wartime Firing Problems!

FUEL shortages, manpower shortages, transportation shortages and time shortages make FYR-FEEDER Spreader Stoker firing advantages more important than ever before.

FYR-FEEDERS:

INCREASE BOILER CAPACITY—"Fire-over-fire" principle increases plant capacity with present boilers.

BURN WIDE RANGE OF COALS—You can draw on the nearest source of fuel and burn it efficiently with a FYR-FEEDER. Coal from 1½" size to dust, or even such fuel as sawdust or wood chips.

ARE EASY TO OPERATE—Simple, quickly responsive, easy to understand. An inexperienced man can successfully handle your firing in short order.

CONSERVE COAL—More efficient burning of fuel produces more steam per pound of coal.

PRODUCE STEAM QUICKER—Instantly and automatically responsive to sudden demands for steam; just as quick in letting go of a load.

CAN BE DELIVERED QUICKLY—The American Coal Burner Company is set up to make exceptionally good deliveries on rated orders.

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western corner of Georgia and about one-third of the northern section of Alabama.

This is one of a series of books which will eventually cover all the bituminous coal producing districts of the United States. In addition to vol. 4 mentioned above the following are now available: Vol. 1 covering Districts 7 and 8, price 55 ct.; Vol. 2, covering District 1, price 50 ct.; and Vol. 3 covering Districts 2, 3, 4, 5 and 6, price 60 ct. Volume 5 covering Districts 10 and 11 will soon be available.

Small Town Manual for Community Action! Size 8 by 10½ in., 46 pp., paper bound. Published by the Bureau of Foreign and Domestic Commerce, Department of Commerce, as Industrial Series No. 4. Government Printing Office, Washington, D. C. Price 5 ct.

This is a bulletin of vital concern to small communities faced with economic problems on account of the war. It tells in detail how to organize community activities so as to further the war effort and at the same time direct the community effort so as to strengthen the post war strength of the community. It tells how to organize community business, handle labor problems, transportation difficulties, improve business, analyze the population factor, and correlate agricultural, industrial, social and recreational activities.

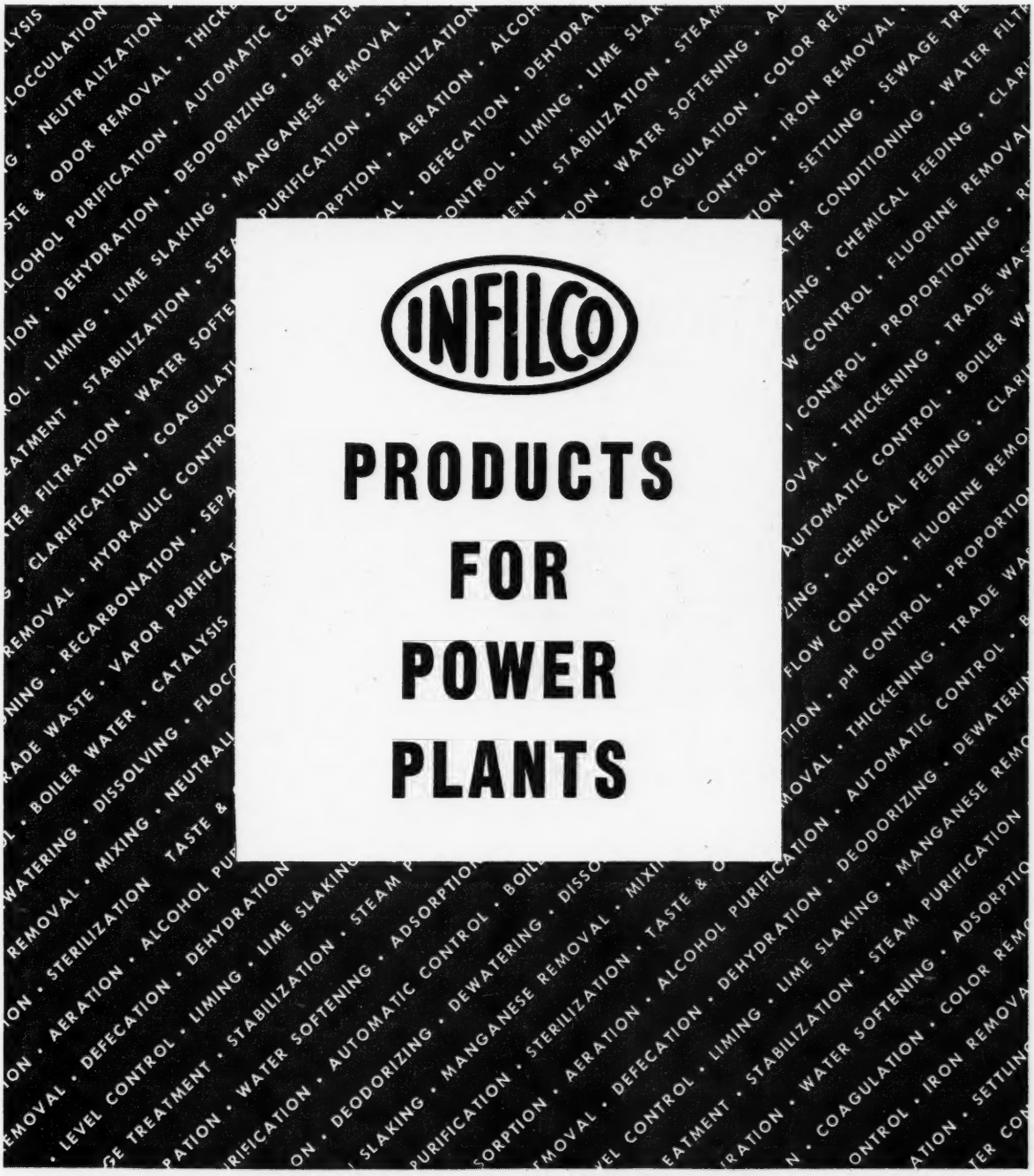
A companion piece is an 8-p. mimeographed bulletin available free of charge from the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C. Its title is Procedures for Conducting Local Wartime Business Clinics. A business clinic is a device for bringing together business people interested in common problems to disseminate accurate information of new conditions and exchange ideas. The booklet tells why the clinics are needed, details of organization, gives hints as to the conduct of the meetings, subjects to be handled and group organization. The last page lists the 29 branch offices of the Department of Commerce which will, upon application, give personal help on the organization of these meetings.

An Introduction to Control Engineering. By Ed S. Smith. Copyright 1942; 134 pp. including supplement of illustrations. 8½ by 11 in.; mimeographed; paper binding. Published by Ed S. Smith, 114-57, 176th St., St. Albans, Long Island, N. Y. Price $2.00

To place before the engineering profession data on engineering instruments that will be of use to anybody working in the art of control, the author has compiled in this limited edition, notes he has used as an instructor at Pratt Institute in a course on engineering instruments designed for students in management and defense training. The reader is assumed to be actively working with industrial instruments of the variable measuring and controlling class, also to have studied college physics and mathematics, although a practical non-mathematical chapter has been included to provide a background. The author has separated his treatise into the following principal sections: Introduction to control, which deals among other things with terminology, descriptions of controls and applications to plants; quantitative analysis of control; various aspects of control, such as transient effects, steady hunting, tests of performance, applications of regulators and present state of the art; physics and lower mathematics used in control; higher mathematics used in control; references; and figures. This work takes up a gap which has heretofore existed between texts on long standardized subdivisions of engineering and the vast amount of material specific to industrial instruments and their applications.

Handbook of Ship Calculations Construction and Operation. By Charles H. Hughes. 1942. Third Edition; 5 by 7 in., 558 pp.; leather bound. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St. New York City. Price $5.00.

Compiled strictly as a handbook of ready information for men engaged in the designing, building and operating of ships, theortical calculations have been purposely omitted from this book which is a compilation of data of immediate use to the naval architect and associated professions. Power engineers will find in one section on machinery data on the overhauling of boilers; on indicator cards; on the operating of pumps, condensers and motors; on fuel and lubricating oils, coal and wood as fuel, steam, boilers, heat exchange and balance; internal combustion and steam engines, turbines and piping. Other sections in the power line deal with electricity; heating, ventilation, refrigeration, air con-



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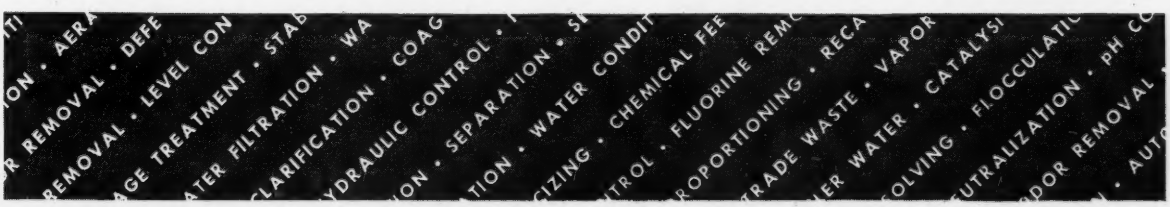

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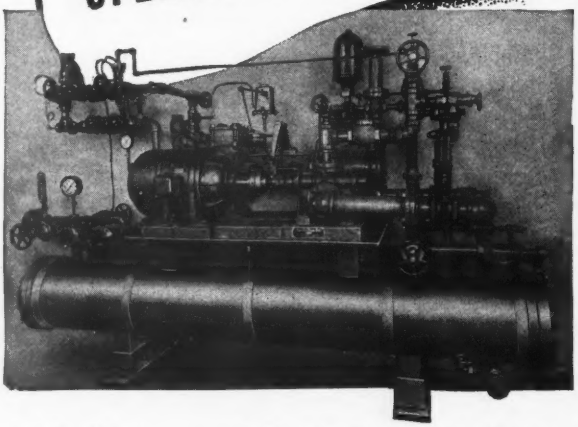

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ditioning; and fire protection. Convenience of use is greatly facilitated by the inclusion of a thoroughly cross reference index of 18 p.

Mathematics of Modern Engineering, Vol. II. By Ernest G. Keller. 6 by 9 in.; 300 p. cloth. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y. Price $4.00.

This volume is devoted to Mathematical Engineering, covering all branches of engineering that can be formulated mathematically. The method is to reduce physical phenomena to a mathematical system, then work out solution of the system. Chapter headings are: Dynamics and Mechanical Vibrations; Tensor Analysis of Stationary Networks and Rotating Electrical Machinery; Non-Linearity in Engineering. The treatment involves higher mathematical equations, using copiously, differential and integral calculus, and requires complete familiarity with such processes.

For those who have the requisite familiarity, the treatment is clear and logical and leads to definite methods of solution. It calls, however, for intense application and can hardly be classed as a simplified method.

Maintenance Hints. Prepared by Westinghouse Engineers. Two volumes, size 5 by 7 in., loose leaf binding, fabricoid cover. Vol. I, 167 pp.; Vol. II, 48 pp. Available free of charge to maintenance men in industry from Dept. 7N 20, Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

Volume I covers inspection of electrical apparatus, insulation materials and applications, the cleaning, drying and testing of insulation, commutator maintenance, starting and regulating a.c., d.c. and squirrel-cage induction motors. All the necessary information for proper maintenance of insulation and motors is given with diagrams, tables, and charts to make the text easy to follow.

Volume II is devoted to contractor maintenance and the inspection of transformers with a chapter on transformer connections. A number of wiring diagrams embrace all of the more common connections for 2 and 3-phase, 25 and 60 cycle, power transmission.

Procedure Handbook of Arc Welding Design and Practice, 1942, Seventh Edition, 1308 p.; 6 by 9 in.; semi-flexible simulated leather cover, gold embossed. Published by The Lincoln Electric Co., Cleveland, O. Price in the United States $1.50, elsewhere $2.00.

Nearly 300 contributors had a part in supplying material for this handbook which is a cooperative effort compiled by the Lincoln Electric Co. to provide as much complete and up-to-date information as possible to help industrial workers produce to the fullest extent. New information is given on such subjects as welding symbols, new allowable stresses, pre-heating for welding, stress relieving, procedures speeds and costs, "Fleet-Fillet" technique, general metallurgical characteristics of metals and alloys, weldability of aluminum alloys, tubular construction, appearance and styling of welded design are covered.

Titles of the eight sections of the Procedure Handbook are: Welding Methods and Equipment; Technique of Welding; Procedures, Speeds and Costs; Objective; Weld Metal and Methods of Testing; Weldability of Metals, Welded Steel Construction—Machine Design; Designing of Arc Welded Structures; and Typical Applications of Arc Welding in Manufacturing, Construction and Maintenance.

Some Factors Influencing the Heat Output of Radiators, known as Bulletin No. 29. By Dr. David Dropkin. Size 8½ by 11 in., 16 p., paper bound. Published by the Cornell University Engineering Experiment Station, Ithaca, N. Y. Price 25 ct.

This bulletin presents the effects of test room insulation, number and arrangement of windows, and the size of radiator on performance under test room conditions. The problem of proper radiator rating is of interest to both the consumer and the manufacturer. The consumer is concerned with securing a source of heat for his rooms which will meet the calculated heat losses under the worst conditions which may be expected for any appreciable duration of time If he purchases radiators which are improperly rated, he will either have insufficient heat, assuming that his calculated heat losses are correct, or he will have more heat than is needed and an excess of capital invested as well as a probable unnecessary waste of heat. From the standpoint of the manufacturers all ratings should be on the same basis in order to enable the progressive company to improve its product.

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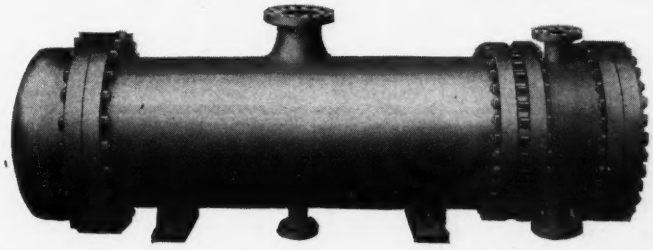

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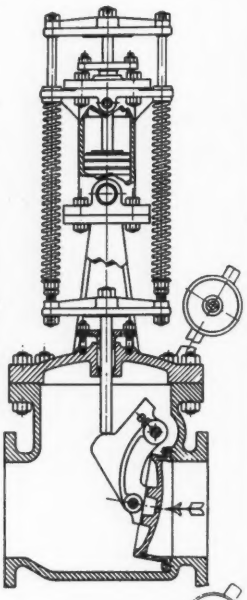
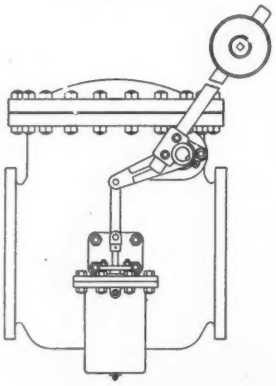
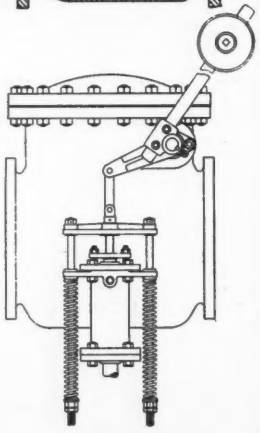


RIGHT—No. 135 with oil control cylinder mounted above valve.

LOWER LEFT—No. 134 with oil dash pot.

LOWER RIGHT—No. 137 with oil control cylinder on side.





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Power Plant Construction News

Ala., Gadsden—War Department, Washington, D. C., has authorized new supply depot at Gadsden, comprising shops, warehouses and other industrial structures. Electric power equipment will be installed, including power substation and distribution system for light and power service. Entire project will cost over $3,000,000, and will be carried out under direction of U. S. District Engineer Office, Atlanta, Ga.

Calif., Fontana—Henry J. Kaiser Co., Latham Square Bldg., Oakland, Cal., plans installation of electric power equipment in new additions to steel mill at Fontana, where initial plant is now in course of construction. A new structural mill, merchant bar mill, alloy steel mill and other structures will be built. Additional power substation facilities will be installed. Entire project will cost about $26,000,000, with financing through Defense Plant Corp., Washington, D. C. Completion is scheduled in 12 mo.

Conn., Cos Cob—New York, New Haven & Hartford Railroad Co., New Haven, Conn., is completing plans for proposed expansion in steam-electric generating station at Cos Cob, initially projected several months ago. Work will include addition to steam division, with installation of new boiler unit and auxiliary equipment. Cost estimated close to $500,000. Gibbs & Hill, Inc., Pennsylvania Station, New York, N. Y., is consulting engineer.

Conn., Hartford—Hartford Electric Light Co., 266 Pearl St., has plans for installation of a new coal-handling and conveyor system, including building and equipment, at South Meadow steam-electric generating station, estimated to cost close to $265,000. Work will be carried out under direction of Stone & Webster Engineering Co., 49 Federal St., Boston, Mass., consulting engineer. This is part of expansion program at this plant, under way for some time past.

Fla., Orlando—War Department, Washington, D. C., has approved plans for new air force base at Orlando, including hangars, shops, warehouses and other industrial buildings. Electric power equipment will be installed, with power substation and electrical distribution system for light and power supply. Complete development will cost over $3,000,000, and will be supervised by U. S. District Engineer Office, Jacksonville, Fla.

Ill., East Moline—Deere & Co., Moline, manufacturer of agricultural implements and machinery, now operating plants for production for Government, plans installation of electric power equipment in connection with expansion in plant in Illinois (exact location withheld). Entire project will cost over $550,000. Financing will be secured through Defense Plant Corp., Washington, D. C.

Ind., Edwardsport—Public Service Co. of Indiana, Indianapolis, Ind., has completed plans for addition to steam-electric generating station at Edwardsport, to include installation of additional equipment for increased capacity. Cost estimated close to $500,000. Work is scheduled to begin at once. Sargent & Lundy, Inc., 140 S. Dearborn St., Chicago, Ill., is consulting engineer.

Ind., Hammond—Jones & Laughlin Steel Corp., Third and Ross Sts., Pittsburgh, Pa., plans steam-electric power station at new steel mill on tract of about 160 acres of land in vicinity of Hammond. It will comprise a large group of one and multi-story buildings and will be used for production for Government. Electric power equipment will be installed, including generator sets, transformers, switchgear, etc. Entire project is reported to cost close to $20,000,000. Financing will be provided by Defense Plant Corp. Work is scheduled to begin at once.

Iowa, Cedar Rapids—Iowa Electric Light & Power Co., Cedar Rapids, has approved plans for immediate expansion in turbine and switch room divisions at local steam-electric generating station, including construction of 2-story and basement addition, about 82 by 100 ft., with installation of equipment for increased capacity. Entire project will cost about $1,200,000 and will be carried out at once. Contract for building erection has been let to Paulson Construction Co., Iowa Theater Bldg., Cedar Rapids.

Iowa, Des Moines—Iowa Packing Co., Maury and 18th Sts., meat packer, has begun superstructure for new 7-story, reinforced-concrete addition, about 80 by 150 ft., to be equipped as a cold storage and refrigerating unit. Cost estimated close to $250,000, including equipment.

La., Eola—Southern Carbon Co., Monroe, La., plans new carbon black plant in vicinity of Eola, including compressor station, boiler house and other mechanical units. Main plant will comprise several one and multi-story processing and production buildings, equipped to handle about 6,000,000 cu. ft. of natural gas daily. Pressure pipe lines will be built for gas transmission from neighboring field. Entire project will cost close to $500,000. State Department of Conservation has granted permission and work will begin soon. Company is affiliated with Columbian Carbon Co., 41 E. 42nd St., New York, N. Y.

La., New Orleans—Higgins Industries, Inc., 521 City Park Ave., operating a shipbuilding plant, plans installation of electric power equipment in connection with conversion of part of works for production of cargo-type aircraft for Government. Cost about $600,000. Financing will be provided by Defense Plant Corp. Work will be placed under way at once.

Mass., Lynn—Lynn Gas & Electric Co., 90 Exchange St., has taken out a permit for addition to local steam-electric generating station at 788 Broad St., for expansion in steam division. Additional equipment will be installed. Entire project is reported to cost in excess of $175,000, and will be carried out at once. Stone & Webster Engineering Co., 49 Federal St., Boston, Mass., is consulting engineer.

Minn., Brainerd—Land O' Lakes Dairy Co., 2201 Kennedy St., N.E., Minneapolis, Minn., a subsidiary of Land O' Lakes Creameries, Inc., same address, has plans maturing for new 1 and 2-story milk hydrating plant at Brainerd, and will begin erection soon. Electric power equipment will be installed. A boiler house will be built. Entire project will cost about $185,000, of which close to $125,000 will be expended for equipment. Max O. Buetow, 1931 University Ave., St. Paul, Minn., is architect.

Minn., Duluth—Barnes-Duluth Shipbuilding Co., Duluth, plans installation of power equipment in connection with expansion in plant for production for Government, including new shops and other structures. Cost over $125,000, with financing to be provided by Defense Plant Corp.

N. C., Charlotte—National Carbon Co., 30 E. 42nd St., New York, N. Y., manufacturer of carbon and graphite products, plans installation of electric power equipment in new plant in vicinity of Charlotte, for manufacture of batteries. Company has taken over a former textile mill in that area and will improve and expand for plant. Cost over $500,000. Financing will be secured through Defense Plant Corp. Company is a subsidiary of Union Carbide & Carbon Co., first noted address.

Ohio, Cleveland—Cleveland Electric Illuminating Co., has approved plans for new indoor-type power substation on Quigley Road, about 60 by 175 ft., estimated to cost close to $200,000, with equipment. Work will be placed under way soon.

Ore., Madras—War Department, Washington, D. C., will begin work soon on new air force base in vicinity of Madras, comprising group of buildings, with hangars, shops, warehouses and other industrial structures. Electric power equipment will be installed, including power substation and electrical distribution lines for light and power supply. A boiler house is planned. Entire project will cost over $2,000,000, and will be carried out under direction of U. S. District Engineer Office, Portland, Ore.

Pennsylvania—Curtiss-Wright Corp., 30 Rockefeller Plaza, New York, N. Y., plans installation of electric power equipment in connection with expansion in plant in Pennsylvania (exact location withheld) for production of airplanes for Government. Cost estimated about $275,000, with financing through Defense Plant Corp.

R. I., Providence—Narragansett Electric Co., 51 Westminster St., has approved plans for new coal-handling and conveyor system at 400 Eddy St., for service at local power plants, including 1-story building and installation of equipment. Cost estimated about $135,000.

Tenn., Union City—Union City Canning Co., canner and packer of food products, plans installation of electric power equipment in connection with proposed rebuilding of plant recently destroyed by fire. Loss reported over $65,000, including machinery.

Wis., Milwaukee—Ampco Metal, Inc., 1745 S. 38th St., manufacturer of bushings, bearings, castings, etc., plans installation of electric power equipment in connection with expansion in plant for production for Government. Cost about $500,000. Financing will be provided by Defense Plant Corp.

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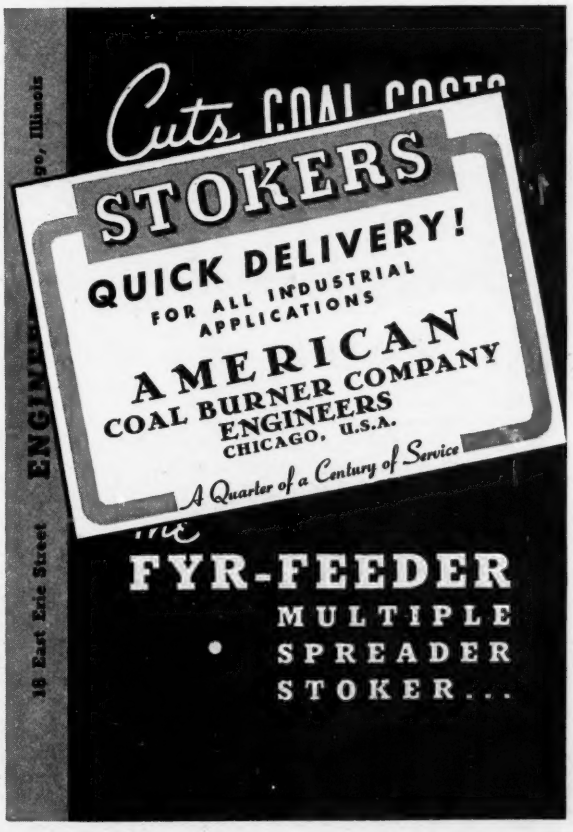

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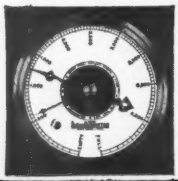

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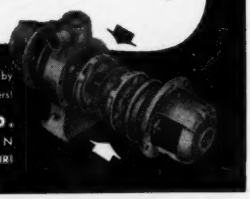

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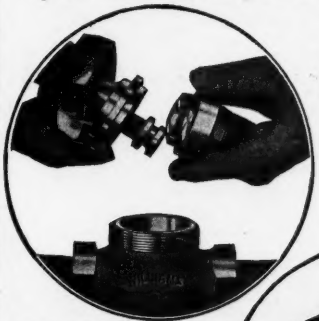

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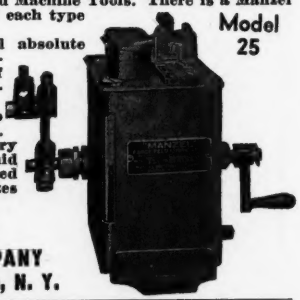

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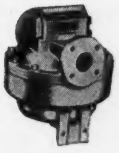

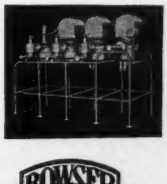

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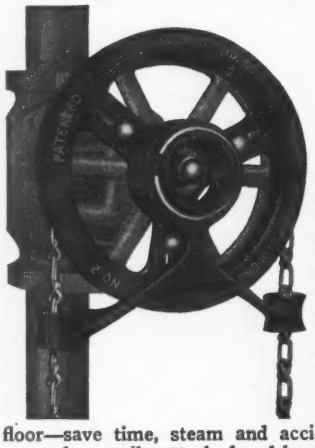

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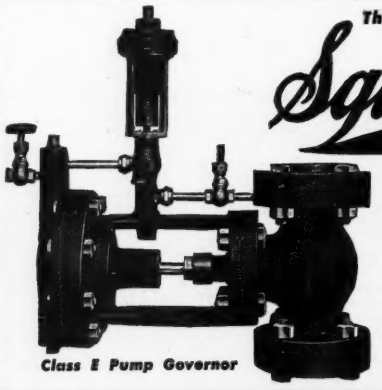

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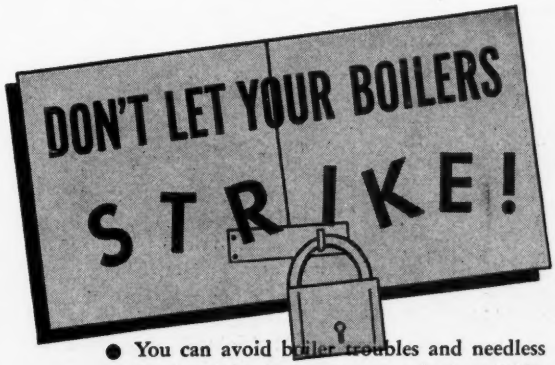

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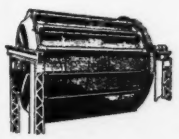

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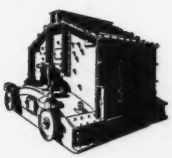

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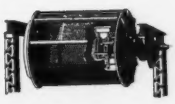

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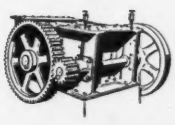

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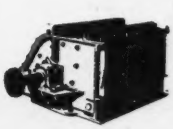

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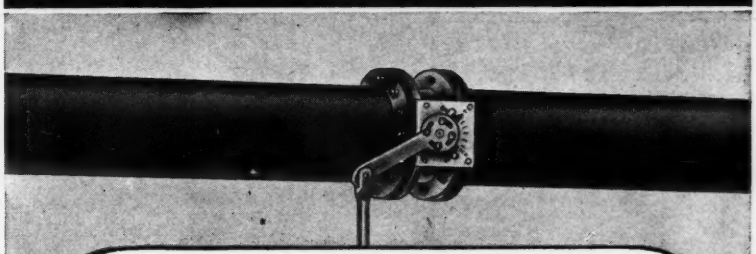
Uniform Pressure Obtained in Inaccessible Line



Uniform pressure is obtained on the downstream side of an R-S Butterfly Valve in an inaccessible line by means of an extended reach rod and an electric motor. The declutching unit and hand wheel control is used when the power fails. Can be powered by an air diaphragm motor or hydraulic cylinder.

As the illustration indicates, the beveled vane closes naturally against the body of the valve and at the correct angle for the wedge-tight shut-off of any material that flows or is forced through a pipe. Machined to exceptionally close tolerances.

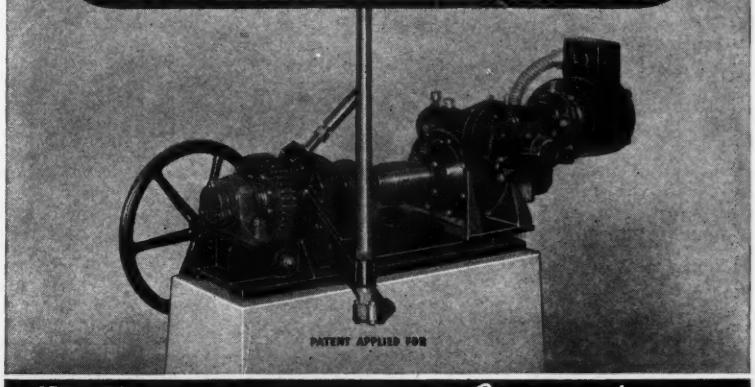
Streamlined construction induces self-cleaning Maintenance is no problem —constructed to last for years. Sizes to 84-inches and pressures to 600 pounds.

Write for catalog, approximate weights and detailed dimensions.

BUTTERFLY VALVE DIVISION

R-S PRODUCTS CORPORATION

4535 Germantown Ave Philadelphia, Pa.

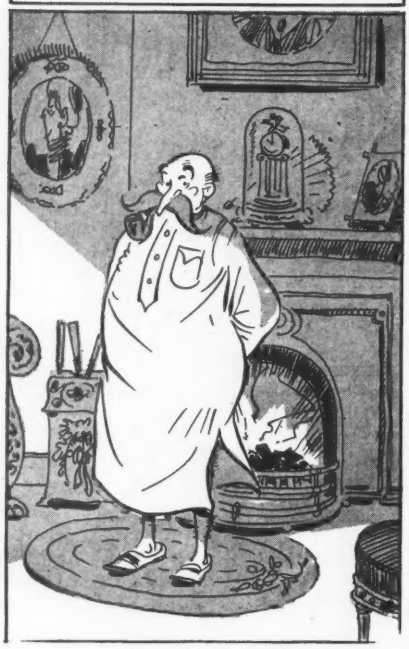


R-S Streamlined BUTTERFLY VALVES

"BOILER ROOM BEN" Pops Off..

One of the old-timers on the engineering staff of Coal Bureau here highlights news and views of interest to steam plant men everywhere

Revised Proverb:
"THERE'S NO FUEL LIKE AN OLD FUEL"



The fact that there aren't enough tankers, tank cars, pipe lines, or trucks to supply fuel oil to the Atlantic Coast and other areas is forcing the changeover to coal for many thousands of industrial plants and service establishments and central stations.

Although these wartime conversions from oil to coal cost money—the plant efficiency and capacity are frequently maintained through improved furnace design, the wider use of modern combustion control instruments, systematic inspection of furnace equipment, etc.

We came across one job recently where a 30,000 lb. per hr. Keeler boiler and a 25,000 lb. per hr. Babcock & Wilcox unit in a dry cleaning establishment, converted to coal, would effect a saving of about 15,000 barrels of oil per year.

To revise a well-known proverb — "There's no fuel like an old fuel."

•

Bituminous Production — Government estimates indicate that close to 570,000,000 tons of bituminous coal will be mined during 1942. Total production in the week ended November 14 was estimated at 11,250,000 net tons.

HINTS ON WARTIME COAL STORAGE

Coal packing affords about 20% more coal storage in a given space. In most plants coal piles are 12 to 15 ft. high; in small plants, 6 to 8 ft. will fit most requirements.

•

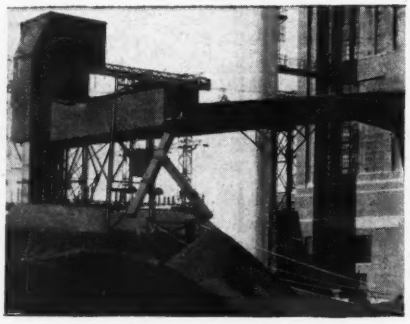
Ground upon which coal is to be stored should be smooth and free from machine turnings, vegetation, wood and all types of industrial waste. Layer piling greatly reduces segregation, increases resistance to airflow and minimizes spontaneous combustion hazard.

•

Coal compacted by bulldozers and rollers will weigh between 62 to 67 lb. per cu. ft. compared to loose coal of 50 lb. per cu. ft.

•

The loss in heating value, measured in B.t.u.'s, due to oxidation while in storage is usually so small that it can be disregarded in present times. Stock piles sufficient to last at least 120 days are being stored in most plants to guard against possible shutdowns.



Tractor-operated bulldozers will handle 1000 tons storage coal per 8 hr. for a distance of 400 or 500 ft. at a total cost, both fixed and operating, not exceeding 5 cents per ton.

HOW TO BURN LOW-FUSION COAL

By careful selection of coal burning equipment and experimental operation, many industrial plants now are maintaining high operating efficiencies with inexpensive grades of low-fusion coal.

For example, a large heating company in Pennsylvania found that by lowering the furnace floors, redesigning the waterwalls and using pulverizers, they can use coal with a fusion point of around 2100 deg. F. and a sulphur content ranging from 1 to 3%. And their boilers carry a 300% load continuously.

Coal Bureau engineers will be glad to make suggestions on how your boiler plant can take advantage of the present-day savings possible with low-fusion coals.

HAVE YOU A CONVERSION PROBLEM?

Good engineering is most essential in converting steam plants from oil to coal fuel. Failure to conform to sound practice with regard to burning rates, heat release, combustion space, radiant heat, boiler baffling, drafts, coal and ash handling equipment may reduce the capacity and efficiency of your plant.

The engineers with Coal Bureau are widely experienced in coping with the various furnace construction and operation problems related to coal conversion programs. You are invited to benefit by this valuable experience. Consultation involves no obligation. Write for new illustrated booklet "Coal" which contains practical coal-burning data.

COAL BUREAU
UPPER MONONGAHELA VALLEY ASSOCIATION
PEOPLES BUILDING • FAIRMONT, W. VA.

For Achievements Beyond the Line of Duty

The Army-Navy Production Award, recently conferred on The Chapman Valve Manufacturing Company, adds a new brigade to the Production Legion of American workers who have consistently worked harder and done more than they had to . . . plainly saying to the Armed Forces, by their accomplishments: "You're putting it on the line for us. And we're trying to do the same for you . . . to give you plenty of what you need, and get it to you in time." This pledge of continuing allegiance to the Army-Navy E Flag is voluntarily made by every man and woman in the Chapman organization.

THE Chapman Valve
MANUFACTURING COMPANY
INDIAN ORCHARD, MASSACHUSETTS

CHICAGO, DECEMBER, 1942

method of housing and *centralizing* Motor Control help solve vital production problems

Unitrol, a simpler, better way of housing Motor Control whether inside a machine, beside a machine, or in a centralized group . . . eliminates many of the operations, interruptions, and obstacles that stand between America and the production it must have.

If you are manufacturing important motorized machines with built-in control, Unitrol speeds up that process by eliminating any need for inside mounting bases, by eliminating many other machining, wiring and assembling operations.

If you have installed or are going to install Motor Control near a group of machines, Unitrol packs Motor Control into a much smaller space, enables you to move Motor Control out of the way, to utilize space otherwise wasted. It eliminates any need for special floor or wall preparation, saves many vital man-hours, conserves vital space.

If you are centralizing Motor Control for an entire plant, Unitrol enables you to do it better, faster, easier, far more economically . . . It enables you to get more than double the amount of control in the same space . . . It enables you to *adapt* your control to the space you have without further preparation or building expense. It expands and contracts easily, to follow your changing requirements.

No man concerned with the mounting, installation, use or maintenance of Motor Control; no man concerned with motorized machine production, can afford to overlook Unitrol. The whole story is told in the book "Unitrol . . . the next step forward in Motor Control progress." It's free for the asking. But write *today—now*—for your copy. CUTLER-HAMMER, Inc., 1392 St. Paul Avenue, Milwaukee, Wis. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto.

← The individual Unitrol mounting frame is *better* for machines with built-in Motor Control. It eliminates many machining, wiring and assembling operations.

→ The individual Unitrol *Section* houses Motor Control for several motors or motorized machines, is compact, space-saving, convenient and economical. No supports, no other structures or preparation necessary.

The complete Unitrol Control Center houses all the control and control equipment in the plant, for easy, speedy man-power-saving installation, maintenance, change, expansion or curtailment. No wall or floor preparation. No racks, trellises or frames. Permits installation of more than double as much control in same space.

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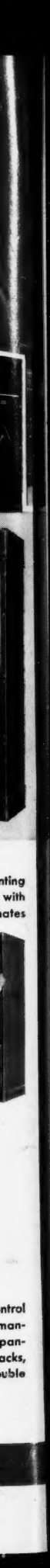
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